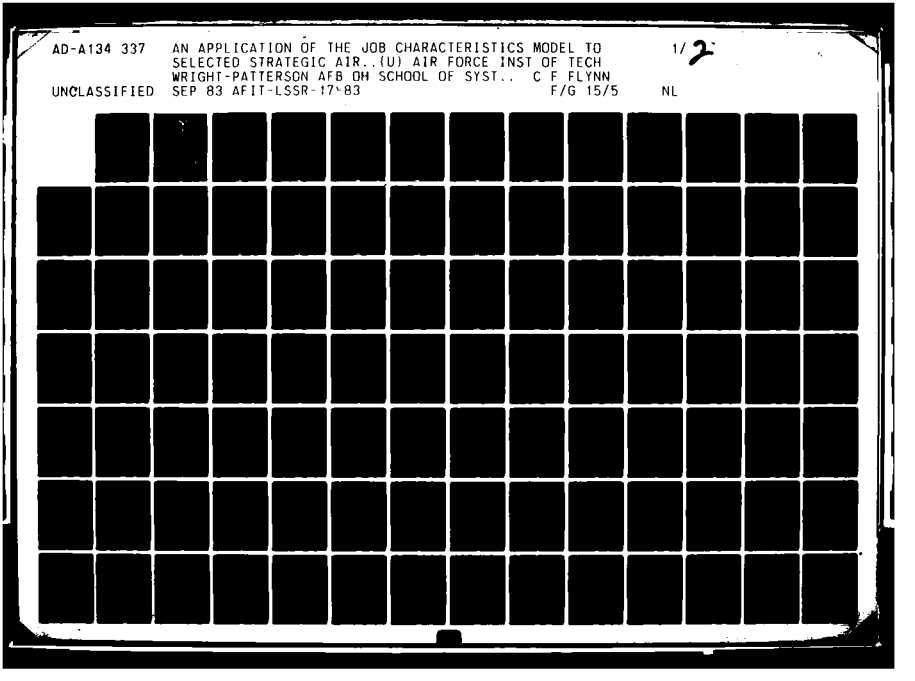
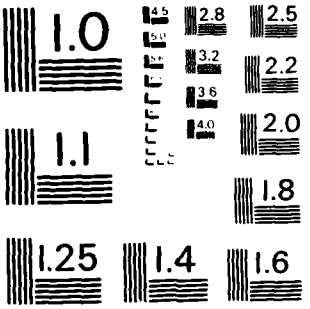
AD-A134 337 AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. C F FLYNN

1/2

UNCLASSIFIED SEP 83 AFIT-LSSR-17-83 F/G 15/5 NL





AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR COMMAND AIRCRAFT MAINTENANCE CAREER FIELDS

Captain Collin F. Flynn, USAF

LSSR 17-83

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

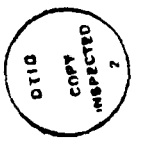
Wright-Patterson Air Force Base, Ohio

AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR COMMAND AIRCRAFT MAINTENANCE CAREER FIELDS

Captain Collin F. Flynn, USAF

LSSR 17-83

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the Air Training Command, the United States Air Force, or the Department of Defense.



A-1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER LSSR 17-83	2. GOVT ACCESSION NO. AD-A134 337	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR COMMAND AIRCRAFT MAINTENANCE CAREER FIELDS		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Collin F. Flynn, Captain, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS School of Systems and Logistics Air Force Institute of Technology, WPAFB OH		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of Communication AFIT/LSH, WPAFB OH 45433		12. REPORT DATE September 1983 13. NUMBER OF PAGES 178
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Approved for public release: IAW AFR 190-17.

LYNN E. WOLAVER
Dean for Research and Professional Development
Air Force Institute of Technology (ATC)
Wright-Patterson AFB OH 45433

15 SEP 1983

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Aircraft Maintenance
Job Satisfaction
Motivation
Strategic Air Command
Attitudes (Psychology)
Enlisted Personnel

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Thesis Chairman: Jerome G. Peppers, Jr., GM-15

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

This study investigates the self-reported job characteristics and work outcomes of Strategic Air Command aircraft maintenance personnel in three career fields. The objective of this research was to diagnose the tasks performed by bomb-navigation systems mechanics (321X0), aircraft maintenance specialists (431X0), and munitions systems specialists (461X0) to isolate strengths and weaknesses in work design. Hackman and Oldham's job characteristics model served as the theoretical basis for the research and the Job Diagnostic Survey was used to collect data for the diagnosis. The survey responses, provided by randomly selected enlisted personnel from each career field, were consistent with the relationships specified in the job characteristics model. Bomb-navigation systems mechanics perceived their work as more enriched than aircraft maintenance specialists and munitions systems specialists. As predicted by the model, they also reported higher job satisfaction, internal work motivation, and growth satisfaction than the other career fields. In general, task significance, task identity, and security satisfaction were noted as strengths across all three career fields. The perceived weaknesses were the level of autonomy, pay satisfaction, and supervisory satisfaction. The research indicates that work design plays a major role in fostering positive work outcomes.

LSSR 17-83

AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR COMMAND AIRCRAFT MAINTENANCE CAREER FIELDS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

Collin F. Flynn, BS
Captain, USAF

September 1983

This thesis, written by

Captain Collin F. Flynn

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 28 September 1983

COMMITTEE CHAIRMAN

READER

ACKNOWLEDGEMENTS

Any successful research effort depends on the cooperation of many people. The author would like to convey his gratitude to all those people who contributed their time and efforts to the completion of this thesis.

I am particularly indebted to my advisor, Mr. Jerome G. Peppers Jr., for his constructive criticism and genuine enthusiasm. His guidance and advice were highly instrumental in giving initiative and direction to my thesis effort. Additional thanks go to Mr. Dennis E. Campbell for his sincere interest in the subject matter and many helpful suggestions. He gave freely of his time and knowledge to the benefit of both the thesis and professional development of the author.

Most importantly, I wish to express my love and heartfelt appreciation to my wife, Donna, for her unselfish support and encouragement during the many hours spent in the research and writing of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

> Don't ask me why or what kind of man would elect such a role, such a life. Rather, tell me why there is a hermit, wizard, nurse, nun, or saint. I don't know! There is no accounting for occupational tastes, but every time I fly I thank fate for a good mechanic [8:11].
>
> Capt Ira C. Eaker
> April 1931

In popular imagination it is the members of the aircrews -- particularly the pilots -- who are the heroes of aerial warfare. Yet, everyone familiar with the reality of the situation -- especially pilots and their fellow crew-members -- recognize their dependence upon the airplane mechanic. In fact, as early as World War I, Air Service officials were declaring that "without efficient mechanics the pilots' wings would soon be clipped and there would be few, if any, ships available with which they could take to the air [2:1]." Today's Air Force maintenance technician is as vital as ever before and is clearly recognized as a key contributor to the war readiness and combat capabilities of our flying organizations. In fact, over one-quarter of our current airman population work in one of the four primary aircraft maintenance career fields to keep our aircraft in peak condition (1:167). However, despite the acknowledged importance of the aircraft technician there are several

problems within this career field that Air Force supervisors and managers must continually attempt to identify, isolate, and solve.

There is sufficient evidence to conclude that the aircraft maintenance career field suffers from personnel problems manifested in dissatisfaction and low motivation which consequently results in high turnover. The attrition rate of Air Force enlisted personnel has been a continuing problem which has only recently begun to improve. However, the loss of highly trained airmen "who provide a reservoir of technological skills and long years of practical experience necessary to operate and maintain our sophisticated weapon systems" is still a major concern (48:72). The Air Force recently released a master list of 72 "chronic critical shortage" skills. This list is used by the Air Force to show key skills in which it has had trouble retaining the needed number of personnel in appropriate grades. Thirty-five of the skills appearing on the list were aircraft maintenance career fields (21:3). Another area closely monitored is the attrition of mid-career personnel which is particularly noticeable in some career fields and which has been cited as a "deep and continuing problem" in maintenance (5:9). In October 1982, to alleviate part of this shortage, three retired non-commissioned officers came back to active duty in the avionics maintenance career field by invitation from the Military Personnel Center. This marked the first

time since the Vietnam era the Air Force has recalled retirees to active duty to ease skill shortages (21:3). Recent news of a military pay freeze for FY84 caused many military leaders to warn of more problems to come. General Barrow, Commandant of the U.S. Marine Corps, stated (28:4) that a pay freeze following a four percent pay cap in FY83 will almost certainly have an "adverse impact on personnel retention, as recent history has dramatically shown, and a long-term negative effect on combat readiness of U.S. military forces." Attrition is indeed a major problem. Present and future Air Force leaders must face this challenge by identifying those factors over which they have some control in an effort to reduce the attrition that threatens our military capability.

As Air Force leaders there are several factors over which we have little or no control. The most notable is pay. Therefore, we must identify controllable factors and initiate programs which will lower attrition and alleviate skill shortages whenever feasible. This fact was reinforced by the Government Accounting Office (GAO) which reported (10:8) that the services "have primarily addressed recruiting and retention issues by requesting more money and, in our opinion, have not adequately informed Congress of other management actions that have caused, aggravated, or could alleviate shortages". The Department of Defense (DOD) conducted another study and concluded (32:1) that dropout

rates for military recruits are influenced heavily by their service experiences, particularly their assignment locations and occupational specialties. The Rand Corporation conducted a third study and reported (32:42) that because attrition rates vary by occupation, it may be possible to reduce personnel losses "by altering the mix of military occupations or enhancing the attractiveness of high attrition occupations." The report concludes that personnel experts should not ignore the impact of "service environment" in trying to curb attrition rates and their associated costs. The common theme of these studies is that Air Force leaders should attempt to deal with dissatisfaction, low motivation, and high turnover by confronting factors in the work environment over which we do have some measure of control. One such factor is the design of the job. This refers to the deliberate, purposeful planning of the job including any or all of its structural or social aspects.

One approach to job design is called job enrichment which attempts to make the work more interesting, challenging, and significant by adding dimensions such as variety, autonomy, feedback, and control. Job enrichment theory proposes that through enriched work employees will attain their personal goals of self-esteem and self-actualization leading to increases in their internal motivation, job satisfaction, and productivity (44:379). This theory has been widely applied in private industry but to a lesser

degree within the DOD. The most notable job enrichment experiment in private industry occurred at American Telephone and Telegraph (AT&T) in the 1960s. Ford (9:96) reported that these experiments "led to increased employee motivation, efficiency and productivity, and reduced turnover." The most extensive application of job enrichment in the Air Force, involving the Air Logistics Center at Ogden, Utah, began in 1974 and continues today. In addition to the Ogden program, six Air Force commands have job enrichment managers. The widespread enthusiasm over the potential of job enrichment is justified according to Umstot and Rosenbach (45:81) who reported:

> Job enrichment consistently improves morale in terms of job satisfaction, organizational climate, satisfaction with supervisors, and other measures. Performance, in terms of improvements in quality and cost saving, may also result. Retention of officer and enlisted personnel who possess critical skills can be expected to improve. Thus, the result will be a better motivated, more committed work force that will translate directly into increased organizational effectiveness and readiness.

Problem Statement

The high quality performance of the aircraft maintenance technician is a vital ingredient of Air Force flying unit preparedness. To insure continued readiness, maintenance supervisors must identify factors which have a negative impact upon job satisfaction and motivation and which may consequently lower the overall performance of

their personnel and their organization. The high attrition of enlisted maintenance personnel is a documented problem which indicates Air Force leaders need to identify controllable factors which can be modified to increase the retention and performance of maintenance personnel. As noted, one controllable factor is the design of the job. When jobs are poorly designed, job satisfaction, motivation, and performance can suffer. Conversely, jobs designed to be interesting, challenging, and significant can have just the opposite impact. This study explores the applicablity of job enrichment to Air Force aircraft maintenance organizations as a tool for increasing the job satisfaction, motivation, and performance of maintenance technicians.

Scope

This research focused on three career fields within Strategic Air Command (SAC) aircraft maintenance, the single largest Air Force command in terms of assigned personnel (1:166). The large size of SAC aircraft maintenance relative to the Air Force maintenance community increased the potential impact of the research. In addition, the centralized maintenance concept used by SAC (explained in Chapter II) is also used by the Military Airlift Command (MAC). Given the similar organizational structures, the recommendations and conclusions derived from this research may be applicable to MAC aircraft maintenance as well.

Three career fields were selected to supply research data. The three career fields are listed below along with a brief description of their associated duties.

1. Bomb-Navigation Systems Mechanic (AFSC 321X0)- "Isolates unit malfunctions and performs organizational and field maintenance on bomb navigation assemblies [40:A17-11]."

2. Airlift/Bombardment Aircraft Maintenance Specialist (AFSC 431X2)- "Inspects, repairs, maintains, troubleshoots, services, and modifies airlift/bombardment aircraft and installed equipment; and performs crew chief and maintenance staff functions [40:A23-15]."

3. Munitions Systems Specialist (AFSC 461X0)- "Receives, identifies, inspects, stores, reconditions, ships, issues, delivers, maintains, tests, assembles guided and unguided nuclear weapons. Locally disposes of non-hazardous ammunition when authorized. Handles and transports nuclear weapons according to existing safety directives and operating procedures [40:A25-7]."

Based on personal knowledge of SAC aircraft maintenance and discussions with Air Force Human Resources Laboratory personnel (3), and former SAC aircraft maintenance officers (27), the author assumed these career fields represented a good cross section of tasks performed by aircraft maintenance in a typical SAC bomb wing. In addition, they served as a good contrast in skill variety, task identity, task significance, autonomy, and feedback from the job which are all measured by the Job Diagnostic Survey (JDS). Details regarding data collection using the JDS appear in the methodology.

CHAPTER II

LITERATURE REVIEW

> Tasks designed solely in accord with the prescriptions of classical management theory and industrial engineering may lead to dysfunctional outcomes for both the organization and the individual worker. Scholars of organizational behavior have suggested that simplified, low skill level, short cycle jobs have led to low motivation, job dissatisfaction, low productivity, and other disruptive behaviors [30:83].

This chapter lays the foundation for the research by examining several distinct subject areas. First, previous research provides insight into the past and present environment in aircraft maintenance organizations. A 1981 study conducted by the Air Force Human Resources Laboratory (AFHRL) (3) at Wright-Patterson AFB, and a related study by Cook and Devault (6), give the most current picture of maintenance technician attitudes today. Second, a brief history of aircraft maintenance and an overview of the centralized concept of maintenance used by SAC today establish a basic understanding of the organization structure that heavily influences the design of tasks. Third, key concepts in job enrichment theory furnish a theoretical basis for the research. Herzberg's two-factor theory (19) and the job characteristics model developed by Hackman and Oldham (17) span the development of job enrichment from the 1950's to the most current research. Finally, successful

applications in both the private and defense sectors justify enthusiasm for the future of job enrichment.

Previous Research in Aircraft Maintenance

In one study, the technical training of aircraft maintenance personnel was evaluated from June 1980 to May 1981 by the Air Force Inspector General (AFIG) (41:3-4). The study was conducted as a result of prior AFIG findings which cited problems in training policy, and program guidance, in preparing aircraft maintenance technicians. As a result, the AFIG recommended the Air Force establish an office of primary responsibility to manage training development problems, develop a new system of training standards, and centralize management of on-the-job training programs.

Another study examined the aircraft maintenance environment through a maintenance management evaluation identified as the Maintenance Posture Improvement Program (MPIP). It was begun in 1975 and was created to establish a continuing program of review, analysis, and evaluation of the effectiveness and efficiency of equipment maintenance in the Air Force (7:26). The program attempted to open the way for imaginative improvements to the maintenance management system and tried to give maintenance managers the opportunity to attack and correct the causes of dissatisfaction expressed by maintenance technicians. A major result of MPIP was the creation of the Production Oriented Maintenance

Organization (POMO) which was a decentralized maintenance concept designed to attack the issues of unrest and dissension among maintenance technicians. Air Force officials were generally pleased with the results of POMO and reported three major benefits. First, it increased sortie production because technicians were trained to work in more than one specialty. Next, POMO simplified the complex dispatch system used in centralized maintenance by assigning specialists near or on the flight line. Finally, it decentralized decision-making authority by increasing the responsibilities of the maintenance squadrons (37:59). In 1980, the Tactical Air Command (TAC) changed the name of this form of maintenance to Combat Oriented Maintenance Organization (COMO) but did not alter its basic structure. In 1983, all tactical flying commands adopted the name change with the publication of Air Force Regulation (AFR) 66-5, titled Combat Oriented Maintenance Organization.

The most recent study was conducted by the Air Force Human Resources Laboratory (AFHRL) in 1981. This study was designed to look at Air Force maintenance as a total environment with interacting problems and complex interrelationships (3:1-2). Two primary assumptions dictated the design of this research. First, people who do maintenance, supervise maintenance, manage maintenance, and plan maintenance are the ones who best know the problems in maintenance. This is similar to the assumptions used in the popular

concept in industry called quality circles. The underlying theme behind quality circles is that the workers have valuable insights into the work environment and management should use this resource to identify, prioritize, and solve problems. The second assumption was that by studying Air Force maintenance as a whole, problems will surface which can be solved through policy changes, through the implementation of an existing technology, or through future research.

The methodology for the AFHRL study was governed by these assumptions and data were collected and categorized in a manner to maximize its usefulness to Air Force managers. The researchers conducted open-ended interviews with 2700 maintenance personnel representing a variety of career fields, skill levels, weapon systems, locations, and maintenance environments. The questions asked were general in nature to prevent interviewer preconceptions from biasing the data collection (6:40). Some of these general questions were: What do you think could be done to improve Air Force maintenance? What do you think could improve your work and attitude on the job? What do you think is the best thing about this squadron? Organization? What do you think is the best thing in the Air Force in general? After statements were collected they were categorized and entered into a computer along with demographic data. In addition, the statements were consolidated into descriptive summaries by

staff members at AFHRL. The ten topics most frequently discussed by the interviewed personnel are listed in Table 1.

Separate summaries of the data for SAC aircraft maintenance organizations were drafted by AFHRL. These summaries highlighted several key problem areas, some of which appear below.

a) The maintenance career field is overspecialized causing some jobs to be boring and repetitive.

b) Flight line (crew chief) jobs lacked status because the credit for fixing the aircraft went to the specialist.

c) Maintenance jobs were very important to the Air Force mission but they lacked both status and respect from the rest of the Air Force.

d) Maintenance personnel were dissatisfied with their work and many complained of oversupervision and a lack of trust by management.

e) Maintenance supervisors did not trust the experience of their personnel or listen to their suggestions.

f) Publications and regulations have overstandardized maintenance and stifled initiative.

g) Maintenance specialists tended to see themselves as being capable of becoming, but not permitted to become, involved in complex maintenance tasks.

h) Maintenance technicians were not able to tie what they do to the overall mission.

i) Management and supervisors were viewed as being able to communicate only in negative terms.

j) The motivated people were required to carry the load for the unmotivated.

TABLE 1
(4:7)

AFHRL STUDY MOST FREQUENT TOPICS

Topic	No. of Statements
1. Retention	472
2. Manpower Availability/ Technicians	371
3. Supervisory Style/NCO's	336
4. Supervisory Style/DCM and Higher Management	284
5. Assignment	255
6. Experience/Competence	243
7. Job Involvment/Caring/ Retiring on the Job	231
8. Work Pressure/Length of Work Days and Weeks	216
9. Spare Parts/Availability	208
10. Cooperation/Competition/ Conflict Within Maintenance	197

k) Current maintenance concepts call for repairs to be shipped out to the depot without giving unit level technicians a chance to fix the item. This promotes the attitude that maintenance personnel don't get to do a complete job and that they just remove and replace black boxes.

l) Vertical communication is bad and workers do not have a clear understanding of what the goals are.

The researchers hypothesized that solutions to most of these problems could be found through policy changes and by applying existing technologies.

In 1982, the AFHRL data for SAC aircraft maintenance organizations was further analyzed by Cook and Devault (6:92). They concluded the overwhelming majority of SAC maintenance technicians at all levels felt problems existed. They further urged that "senior Air Force officers and SAC management must research and seek to validate and find solutions to these problems." However, before such research is conducted, one must understand the organizational structure of SAC aircraft maintenance.

SAC Aircraft Maintenance Structure

The organizational structure of Air Force maintenance units has evolved over the years. to the point where two primary structures dominate today. The first structure is a centralized concept which is set forth in AFR 66-1, titled Maintenance Management. This structure is used by both the Strategic Air Command and Military Airlift Command. The second structure is Combat Oriented Maintenance Organi-

zation (COMO) and is designed for use by tactical units. This review focuses on the centralized concept.

Over the past thirty years the structure of SAC aircraft maintenance has generally moved toward increased centralization and specialization for two primary reasons. First, increased budgetary pressures challenged the services to "do more with less" which forced Air Force leaders to seek more efficient use of personnel. By reorganizing aircraft maintenance organizations along functional lines into four specialized squadrons, SAC accomplished this goal. Second, the increasing complexity of aircraft subsystems meant the Air Force could no longer rely on crew chiefs to maintain their proficiency on all the various subsystems (22:49-52). This resulted in increased specialization of technicians which is the basis for SAC's organizational structure today. The intent of this structure , as established by AFR 66-1, Volume I, is:

> Maintenance, as a functional element of the organization, is responsible for ensuring that Air Force material is serviceable, safely operable, and properly configured to meet the mission needs [42:2].

Aircraft maintenance organizations in SAC are organized along functional lines with centralized control resting with the Deputy Commander for Maintenance (DCM) as shown in Figure 1. The DCM plans, schedules, controls, and directs the use of all maintenance resources to meet mission

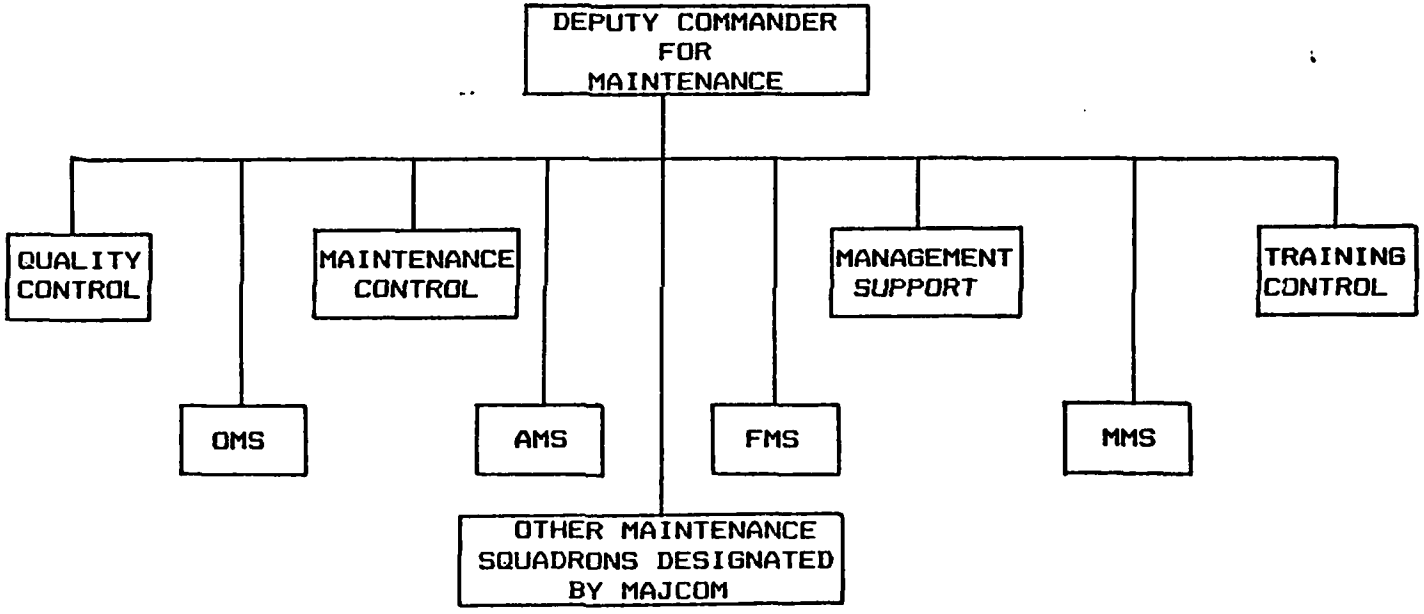


FIGURE 1

ORGANIZATIONAL CHART OF DCM COMPLEX
(42:5)

requirements. He and his staff provide direction and guidance for subordinate maintenance activities to implement and to comply with all local and higher authority maintenance policies and technical instructions (39:1-1). The DCM is responsible for coordinating and directing four maintenance squadrons and associated staff functions.

The four squadrons are Organization Maintenance Squadron (OMS), Avionics Maintenance Squadron (AMS), Field Maintenance Squadron (FMS), and Munitions Maintenance Squadron (MMS). The OMS is composed of crew chiefs, phase teams (preventive maintenance), the post-flight teams, refueling teams, and tow teams. These personnel conduct on-equipment maintenance and are usually organized into an alert force branch, transient aircraft branch, flightline branch, inspection branch, and support equipment branch (43:2-1). The second squadron is AMS which repairs avionics systems such as radar, radios, navigation and bombing computers, LORAN, and radar altimeters. Avionics Maintenance Squadrons are normally composed of several branches such as, communication-navigation; mission systems; automatic-flight control, instrument and precision measuring equipment laboratory; aircrew training devices; avionics test, measurement, and diagnostic equipment; and, post attack and control functions (43:4-1). Field Maintenance, the third squadron, performs work on aircraft systems, such as fuel, electrical, engine, hydraulic, inflight refueling, ejection

seats, sheet metal, aircraft structural repair, and wheel and tire systems. The final squadron is MMS. These personnel load and maintain conventional and nuclear munitions, guns, missiles, weapons suspension and release systems, and associated support equipment. The four sub-elements of MMS are munitions services, maintenance and storage, equipment maintenance, and explosive ordinance disposal (43:5-1).

The DCM also supervises some important staff functions, such as Maintenance Control, Quality Control, Management Support, and Training Control. Maintenance Control is responsible for directing the maintenance production activities, authorizing the expenditure of resources, and controlling the actions required to support the mission. It manages the full cycle of production by planning, scheduling, directing, and controlling all maintenance on primary mission, mission support, and transient aircraft (39:2-1). To accomplish these functions, Maintenance Control is divided into functional elements, one of the most important of which is Job Control. Job Control directs and controls the use of maintenance resources to insure a coordinated, efficient effort (39:2-2). Another support function is Quality Control. Personnel in Quality Control evaluate the quality of maintenance done by the maintenance squadrons. In addition they conduct the Maintenance Standardization and Evaluation Program. Management

Support is set up to perform duties in the maintenance complex which are not specifically related to the control of maintenance production. Duties such as administration, production analysis, training management, computer files maintenance, and mobility are accomplished by Management Support. Finally, Training Control, as the name implies, conducts and coordinates the training of locally assigned maintenance personnel.

Job Enrichment

> Job enrichment seeks to improve both task efficiency and human satisfaction by means of building into people's jobs, quite specifically, greater scope for personal achievement and its recognition, more challenging and responsible work, and more opportunities for individual advancement and growth [26:61].

The job enrichment approach to redesigning work grew out of experiments conducted in the early 1960's at American Telephone and Telegraph and is closely associated with the motivational theories of Frederick Herzberg. Job enrichment attempts to ensure that workers' jobs have certain basic characteristics. First, the job should be a complete piece of work in the sense that the worker can identify a series of tasks or activities which result in a definable product for the client. In other words, after performing the required tasks, the worker should be able to perceive a definite change in the product or service for which he is

responsible. Second, the worker should have as much decision-making control as possible over how he or she executes that complete piece of work. Such things as deviation from prescribed methods and procedures in unusual situations and scheduling of work by the worker are aspects of decision-making control. Finally, workers should be provided with direct information on how well they are doing their jobs. This feedback should come from the work itself (49:8-9).

Several researchers have made significant contributions to the development of job enrichment as an applied tool of management. The most noteworthy contributor in the early stages was Frederick Herzberg. Most recently the combined works of J. Richard Hackman and Greg Oldham have added to both the theory and application of job enrichment.

Herzberg's Two-Factor Theory. Prior to the work of Herzberg, the dominant motivation theme was the classic approach. The classic approach asserted the importance of the work environment over other factors in motivating employees. Herzberg agreed with the importance of the work environment but did not consider it sufficient, within itself, for effective motivation. He believed a more important set of factors dealing with the work itself held the key to employee motivation.

Herzberg formalized this concept of employee motivation in his now famous two-factor theory of motivation. The

two-factor theory resulted from a study in which Herzberg and his associates surveyed 200 accountants and engineers from nine firms of varying size and nature. The major question the study hoped to answer was whether different kinds of factors were responsible for bringing about job satisfaction and job dissatisfaction (19:57). Herzberg found that factors in the work itself, responsibility, and advancement are almost always associated with long-term changes in job attitudes. Rarely did they cause a transient change. In addition, factors that promoted good feelings about the job related to doing the job (intrinsic content of the job), rather than to the context in which the job was done (19:70). These good feelings had a significant impact upon other job related measures as well.

Herzberg also presented findings on the relationship between employee attitudes concerning the job and specific work outcomes, such as performance, turnover, and feelings about the company (19:86-87). First, attitudes toward the job exerted an extremely important influence on the way in which the job was done. Second, the tendency for attitudes to have an affect on performance was greater for favorable attitudes toward the job than for unfavorable ones. With respect to turnover, Herzberg concluded that negative job attitudes promoted some degree of physical or psychological withdrawal from the job (19:89). Finally, positive job attitudes led to favorable attitudes about the company and

negative job attitudes led to a lower regard for the company as a place to work (19:90). As a result of the attitudes expressed by the respondents, Herzberg proposed the two-factor theory of motivation.

The two-factor theory, also known as motivation-hygiene theory, proposes that factors inherent in the work itself (motivators) and environmental factors (hygiene) combine to affect job attitudes. Motivators come from factors intrinsic to the work such as achievement, recognition, the work itself, responsibility, advancement, and growth. Conversely, hygiene factors largely result from extrinsic, non-job-related factors, such as company policy, salary, coworker relations, and supervisory style. Herzberg argued that eliminating the causes of dissatisfaction (through hygiene factors) would not result in a state of satisfaction. Instead, it would result in a neutral state. Satisfaction and motivation would occur only as a result of the use of motivators (36:393-4).

The implications of this model of employee motivation are clear. Motivation can be increased through basic changes in the nature of an employee's job which is the basis for the concept of job enrichment. Therefore, jobs should be redesigned to allow for increased challenge and responsibility, opportunities for advancement, personal growth, and recognition.

Herzberg's theory has provoked both support and

criticism over the last twenty years. To support his theory, Herzberg conducted five studies in British firms. In all five studies, jobs were changed to draw upon all the motivators described in the theory. In each study, Herzberg confirmed the validity of his original research (26:61-78). Dunnette and Kirchner (47:392) evaluated research critical of Herzberg and concluded that the critics were guilty of three basic errors: misinterpretation of the theory, methodological weaknesses, and misinterpretation of results. They concluded that the motivation-hygiene theory was indeed important because it clearly demonstrates the ability to identify and clarify the underlying sources of job attitudes, has explanatory powers, has generated further research, and is a useful prediction tool (47:412-13).

Critics of Herzberg's theory have generally cited one of three reasons for disagreement (20:371-5). First, the methodology of collecting data via storytelling is highly biased. According to Vroom (20:372), "the story-telling methods may have very little bearing on the actual consequence of managerial practice." Second, critics charge that the foundation for the research is faulty because classifying reactions as either motivator or hygiene factors is left to the interpretation of the rater. These same critics cite Herzberg's use of inadequate operational definitions, the original study's lack of an overall measure of satisfaction, and the absence of reliablity data for the

critical-incident method. Finally, researchers have charged that Herzberg's findings are inconsistent with previous evidence. Motivation is only one condition necessary for productive work. Clearly, when working conditions, the quality of leadership, the suitability of supplies and equipment, the efficiency of scheduling and coordination procedures, or the abilities of the members of the work force are deficient, highly motivated behavior may have either little or no effect on productivity (20:383-4). Despite the criticisms, Herzberg's theory is still acclaimed as having made significant contributions to the theory of motivation and was the basis for the work of Hackman and Oldham.

Job characteristics model. According to Hackman and Oldham (17:ix), "Lots of jobs are not so well designed. They demotivate people rather than turn them on. They undermine rather than encourage productivity and work quality. They aren't any fun."

The job characteristics model developed by Hackman and Oldham is an outgrowth of job characteristics theory and the major studies performed by Arthur Turner and Paul Lawrence. Turner and Lawrence examined the relationship between certain objective attributes of tasks and employee's reactions to their work. They concluded that managers can build into jobs those attributes which create conditions for high work motivation, satisfaction, and performance (17:59-61).

The basic job design model by Hackman and Oldham is shown in Figure 2. The model proposes that five core job dimensions create three psychological states which in turn satisfy different individual and organizational objectives. The effectiveness and efficiency of the model is moderated by individual growth need strength, context satisfactions, and the knowledge/skill of the employee (16:58). The job characteristics model, offered by Hackman and Oldham, is a tool for understanding employee attitudes about their jobs, diagnosing existing jobs, and mapping out specific action steps for change when needed. However, it does not represent an end in itself in the study of job design. Instead, it is an attempt to extend, refine, and synthesize previous research in this area. As such, there are both limitations to the proposed model relationships and criticisms regarding how the model can be operationalized. In order to properly acknowledge these issues, the model is first presented in its purest form. Then, limitations of the model are briefly discussed in recognition of potential avenues for research aimed at clarifying the basic model. Finally, specific criticisms of the model are highlighted to give the reader a clear picture of its weaknesses and potential areas for future improvement.

According to Hackman and Oldham (16:58), three psychological states are critical in determining a person's

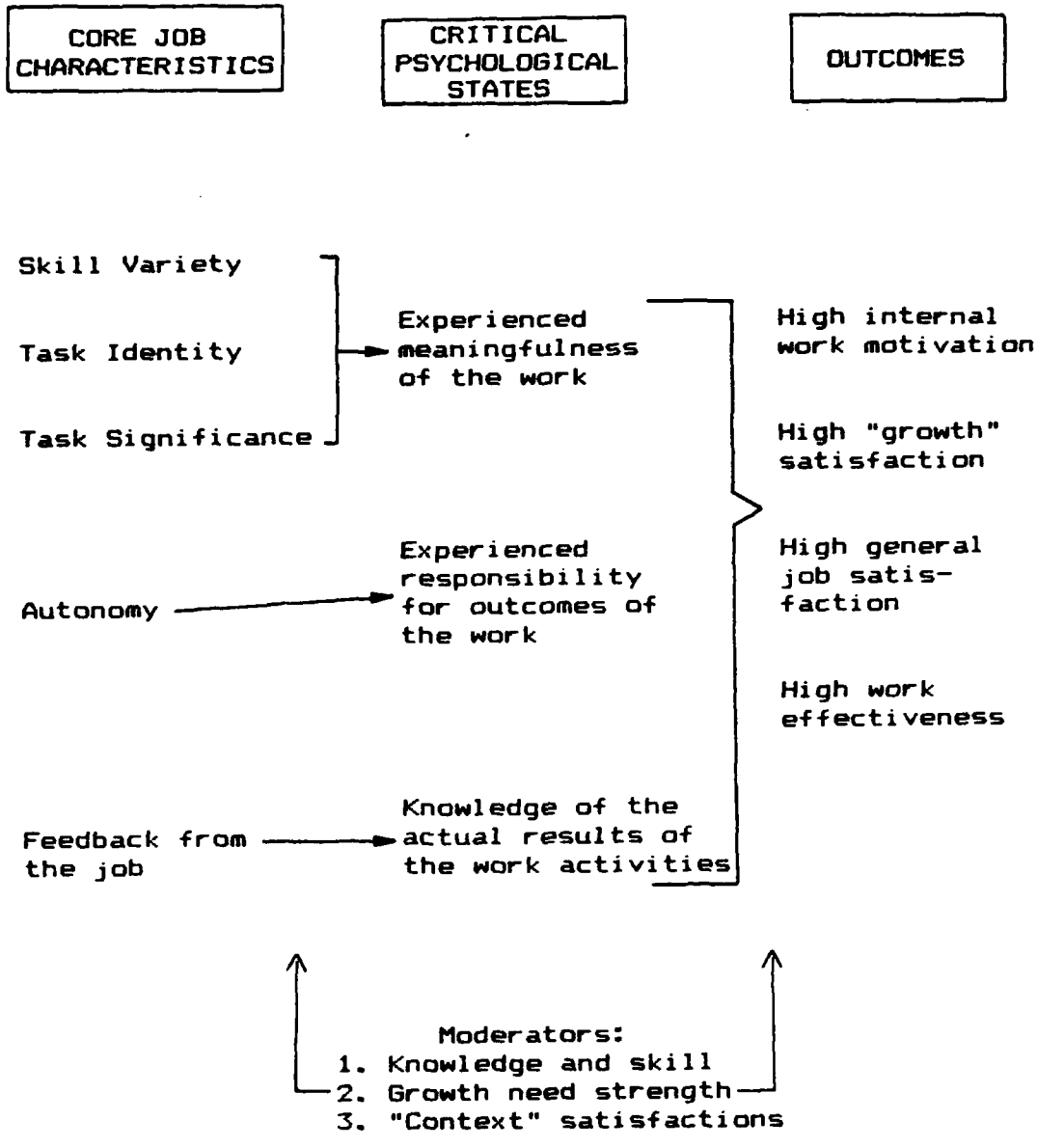


FIGURE 2

JOB CHARACTERISTICS MODEL
(17:90)

motivation and satisfaction on the job. These three states are defined below.

> Experienced meaningfulness: The individual must perceive his work as worthwhile or important by some system of values he accepts.
>
> Experienced responsibility: The individual must believe that he personally is accountable for the outcomes of his efforts.
>
> Knowledge of results: The individual must be able to determine, on some fairly regular basis, whether or not the outcomes of his work are satisfying.

When these three states are present, a person tends to feel very good about himself when he performs well. These good feelings will prompt the worker to try to continue to do well, which is the concept behind internal motivation. When the worker is turned on by his work because of the positive internal feelings generated by doing well, rather than being dependent on external factors, he is internally motivated. If one of these psychological states is missing, internal motivation drops markedly. To complement their discussion of the three states, the authors propose five core job dimensions which directly influence the psychological states.

According to the job characteristics model, three core job dimensions influence the experienced meaningfulness derived from a task. The three dimensions are skill variety, task identity, and task significance. They are

defined below (16:59).

> Skill variety: The degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents of the person.
>
> Task variety: The degree to which a job requires completion of a "whole" and identifiable piece of work, that is, doing a job from beginning to end with a visible outcome.
>
> Task significance: The degree to which the job has a substantial impact on the lives of other people, whether those people are in the immediate organization or in the world at large.

Each of these three job dimensions represents an important route to experienced meaningfulness. If the job is high in all three, the worker is quite likely to experience the work as meaningful. One or two of the dimensions might be low but if the third is high the worker may still find the job meaningful.

Autonomy, the fourth job dimension, leads a worker to experience the state of increased responsibility in his job. Hackman and Oldham define autonomy as shown below (16:59).

> Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out.

They propose that people in highly autonomous jobs know they must accept responsibility for successes and failures. Therefore, the individual's efforts and initiatives will directly influence how well the work is accomplished.

The fifth and final core job dimension is feedback and is defined below (16:59).

> Feedback: The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance.

Feedback leads to the psychological state called knowledge of results. Although useful feedback can come from co-workers, or any level of management, Hackman and Oldham believe the most powerful feedback is that which comes from the work itself. Effective feedback is fostered by giving a worker accountability as well as holding him responsible for the work.

As depicted in Figure 2, the five core job dimensions combine to affect the three psychological states which in turn produce the personal and work outcomes shown. The authors also believe combining the five core job dimensions into a single index provides an informative measure of the overall potential of a job to foster internal motivation within the worker. This single summary index is called the motivating potential score (MPS) of a job. Arithmetically, the score is the product sum of the three critical psycho-

logical states (17:81).

$$\text{Motivating potential score (MPS)} = \left[\frac{\text{Skill variety} + \text{Task identity} + \text{Task significance}}{3}\right] \times \text{Autonomy} \times \text{Job Feedback}$$

As the formula indicates, a job high in motivating potential must be high in at least one (and hopefully more) of the three dimensions that prompt experienced meaningfulness, and high in both autonomy and feedback as well. A high MPS does not mean that the worker will automatically be motivated. What it does mean is that the stage has been set for internal job motivation to occur if the employee performs well and desires growth on the job.

Three moderators determine how individual workers will react to the motivating potential of their jobs. First, the knowledge and skill of the worker influences the eventual outcomes. According to the model, when a job is high in motivating potential, people who have sufficient knowledge and skill to perform well will experience substantial positive feelings as a result of their work activities. Conversely, people who are not competent enough to perform well will experience a good deal of unhappiness and frustration at work, precisely because "doing well" is important to them (17:84). The second moderator is growth need strength. Not all individuals appreciate the opportunities for self-direction, learning, and personal accomplishment at work. Therefore, the psychological needs of

the worker are critical in determining how vigorously an individual will respond to a job high in motivating potential. When people have strong needs for personal accomplishment, they are said to have strong growth needs. These people will develop high internal motivation when working on complex jobs. In contrast, people with low growth needs will be less eager to exploit the opportunities for personal accomplishment provided by a job high in motivating potential (17:85). The final moderator is satisfaction with the work context. The worker's satisfaction with certain aspects of the work context may affect his willingness or ability to take advantage of the opportunities for personal accomplishment provided by enriched work (17:86). These moderators influence the general proposition that increases in the motivating potential of a job foster general internal motivation on the part of the people who perform the work.

Probably the most important aspect of the model for managers are the expected outcomes. First, there are several personal outcomes some of which have already been discussed. Along with internal motivation, workers are generally more satisfied with their personal learning and their growth at work (growth satisfaction), and the work as a whole (job satisfaction). Second, work quality and quantity are two measures of work effectiveness expected to benefit from the enrichment process. Finally, attendance at work should improve. When jobs are motivationally improved,

employees should find the workplace more attractive and therefore want to come to work more regularly.

Hackman and Oldham acknowledge certain limitations of the model (17:95-7). Evidence for the proposed moderating effects is scattered. In particular, the moderating effects of knowledge and skill have not been systematically tested. In addition, there is important evidence that individuals differ in their motivational readiness. How to construe or measure these differences is at issue. Another limitation is the link between job characteristics and the psychological states which is not as neat and clean as expected. Also related to job characteristics is the fact that the model treats them as independent which is not always the case. The concept of feedback is also somewhat flawed because it is difficult to determine what is "job based" feedback and what is not. Finally, how objective properties of jobs relate to people's perceptions of these properties is not completely clear.

Another limitation of the model is its failure to address the impact of enriched work on those employees who do not desire to perform a particular job. The model implies that upon the redesign of work these individuals will experience the anticipated work outcomes when in actuality this is highly unlikely. An example helps to illustrate this point. When the economy is performing poorly and unemployment is high, an individual may accept

work that normally he would not be willing to perform. His intentions may be to tolerate the job while constantly trying to find more suitable work or until the economy shows signs of recovering. In all likelihood, any attempts to enrich the work of this individual will not lead to the anticipated work outcomes of higher motivation, satisfaction, and increased productivity. This issue is particularly important to consider when applying the model in the military environment. Due to critical skill shortages, it is not uncommon for new recruits to be forced into career fields that are not consistent with their goals or interests. This can cause frustration and dissatisfaction which is unlikely to be remedied simply by enriching the job being performed. This issue may represent an additional moderator not explicitly stated in the model or a factor that is measured by the growth need strength. In either case, this limitation must be considered when diagnosing work situations prior to job redesign.

In addition to these limitations, there are also some relevant criticisms of the job characteristics model. Two of these criticisms concern the lack of situational specifications and lack of clear evidence to support performance outcomes. Four studies/reviews highlight some of the criticisms dealing with situational specifications. Roberts and Glick (33:196) cited confusion with the model which appears to be a direct consequence of lack of clear

distinction among within-person, person-situation, and situational relations in the job characteristics model. They contend the model would greatly benefit from clear specification of particular situational and social influences on task perceptions. The importance of the work context was also acknowledged by Oldham, Hackman, and Pierce (25:402) who concluded that prior to enriching jobs, practicioners should carefully assess both individual differences in needs and contextual sources of dissatisfaction. In a third study, Rousseau (34:21) cited the absence of any incorporation of sociotechnical systems theory in the job characteristics model and its failure to consider the interrelatedness of jobs in the redesign of work. Finally, Pierce, Dunham, and Blackburn (31:239-240) examined the main and interaction effects of social system structure, job design, and growth need strength. Their research showed the independent variable, job design, had a main effect and interaction effect with both growth need strength and social system structure. They suggest the full effects of job design cannot be understood without knowledge of both the worker and the organization (social system structure).

In addition to the above criticisms, other researchers have questioned the relationship between job core dimensions and performance. Steers and Mowday (35:652) concluded that studies have failed to support the model's

predictive power with respect to employee performance, although support for its predictions of perceived motivation and job satisfaction were found. Umstot, Bell, and Mitchell (44:392) found clear causal support for the proposition that manipulating job aspects can create feelings of enrichment and these feelings cause different degrees of satisfaction. However, they found little relationship between job characteristics and productivity. Finally, Griffin, Welsh, and Moorhead (11:662) reviewed the research literature dealing with the task design/performance linkage and found the results inconclusive. One explanation is the available studies, with a few exceptions, were characterized by potentially invalid and meaningless performance measures. Their recommendation was for future research to prescribe a more precise formulation of task design and performance interrelationships, investigate the causal relationships between task design and performance, and integrate organizational context variables into the study of task design variables. In summary, the model has been criticized primarily for lack of situational specifications and support for performance outcomes.

Despite its limitations and criticisms, the author believes the job characteristics model is a powerful tool in the field of job diagnosis and enrichment, if wisely applied. Its wise application calls for the researcher to recognize these limitations and criticisms and to avoid

presupposing the model contains all the answers to the employee motivation problem. The model does represent a tested theory of motivation which offers the manager and the organization valuable insight into specific aspects of job design which may be fostering negative work outcomes.

Job Diagnostic Survey. Hackman and Oldham also developed the Job Diagnostic Survey (JDS) to complement their work on the model and to encourage the systematic diagnosis of focal jobs. They strongly emphasized the importance of job diagnosis before any effort is undertaken to enrich the nature of tasks. Therefore, they developed the JDS to promote the systematic diagnosis of organizations and to avoid the risks of managerial intuition (17:100-102). According to Hackman and Oldham (15:276), the JDS can be used for "the diagnosis of jobs being considered for redesign (e.g. to determine the existing potential of a job for engendering internal work motivation, to identify those specific job characteristics that are most in need of improvement, and to assess the readiness of employees to respond positively to enriched work)." In addition, the effects of work redesign can be evaluated using the JDS. However, the JDS does not assess the level of employee knowledge and skill (moderator), employee work effectiveness (work outcome), or the employee's desire to perform the focal job. In summary, the complimentary nature of the job characteristics model and the Job Diagnostic Survey

(discussed in detail in the methodology) can provide management with a powerful tool to explore the applicability of job enrichment to focal jobs in their organizations.

Applications of Job Enrichment. One of the first applications of job redesign occurred in 1943 at International Business Machines (IBM) under the direction of the president of IBM, Thomas Watson (49:11). The experiment at IBM dealt primarily with job enlargement which is only one aspect of total job enrichment. However, its implications for future applications of job redesign were very important. The effort was initiated in the parts manufacturing department of the IBM Endicott plant and primarily involved adding skills and responsibilities to the plant's single-operation workers. The anticipated benefits of better quality products, less idle time for machines and operators, and enriched jobs for the workers were all achieved. According to IBM management (46:56), "The worker received from the plan an increase in personal satisfaction on the job, plus higher wages. The consumer got the benefit of the improvement in quality of the product."

The experiment which probably created the most widespread interest in job enrichment was the program implemented at American Telephone and Telegraph (AT&T) in the late 1960's. The experiment, conducted over a seven year period, was closely associated with the popular motivation theory of Frederick Herzberg. Ford (9:105-106)

reported on some of the major lessons learned. First, job enrichment does pay off through increased productivity and a cost saving reduction in the size of the work force. In addition, job enrichment requires a big change in managerial style which includes moving control downward and increasing methods for feedback. In addition, he cautioned against neglecting organizational maintenance factors, such as office layout and equipment, while pursuing a program of job enrichment. Finally, he encouraged managers to observe new technologies as they are adopted by the organization to insure that human beings don't become the adjunct of machines. These two cases represent a small sample of the applications of job enrichment in private industry. As a result of these successes and similar programs at Texas Instruments, and the Polaroid Corporation, interest in job enrichment and debate over its merits has rapidly increased (36:441-444).

Over the last ten years, numerous examples of both successful and unsuccessful job enrichment programs have appeared in business and behavioral periodicals. Unfortunately, the question of how practical a management tool job enrichment might be has been obscured by a tendency towards overstatement on the part of advocates and detractors alike (49:12). Pierce and Dunham (30:87) attempted to synthesize the research in a 1976 literature review on the results of job enrichment research. They concluded:

> Task designs are more frequently associated with positive affective, behavioral, and motivational responses than are narrowly defined tasks. Two of seven survey research investigations suggest that increases in task variety are not necessarily associated with increases in satisfaction and motivation. Affective and motivational responses appear to be more strongly related to task design than are behavioral responses. Satisfaction with work is more strongly related to task design than are other affective, behavioral or motivational variables (30:87).

The Air Force has also experimented with job enrichment. The first program was started in 1974 at the Ogden Air Logistics Center under Herzberg's guidance (45:75). Results of these projects were so successful that job enrichment was expanded to include all five of the air logistics centers. As of early 1979, Air Force Logistics Command (AFLC) had 376 job enrichment projects under way. The successes in AFLC caused job enrichment to be implemented in other commands. In 1975, security specialists in SAC had their jobs enriched resulting in improved job satisfaction, improved satisfaction with supervision, and improved attendance. In 1976, a Tactical Air Command (TAC) transportation squadron underwent a job enrichment program. Although results were not spectacular, significant improvements in morale resulted from the program (45:75).

Summary. To date, no single approach to job enrichment has provided the solution to all "work-related" problems in society and, more specifically, the Air Force. Fortunately, the cumulative knowledge derived from the work

of researchers, such as Herzberg, Hackman, and Oldham, have provided valuable tools to management. Today, we are better equipped than ever before to apply the most up-to-date methods of management and behavioral theory to the problems faced by Air Force personnel.

CHAPTER III

PURPOSE OF THE RESEARCH

Research Objectives

The objective of this research is to diagnose the existing tasks accomplished by SAC aircraft maintenance technicians in three career fields: bomb-navigation systems mechanic, aircraft maintenance specialist, and munitions systems specialist. The purpose of this diagnosis is to accomplish the following:

1. Determine if any of the selected career fields exhibit low job satisfaction, low internal work motivation, or low growth satisfaction.

2. Determine if any of the selected career fields are rated as low in motivating potential.

3. Analyze each career field that is low in motivating potential to identify specific aspects of the job that are causing or contributing to low satisfaction or motivation.

4. Determine if job redesign is an applicable strategy for any of the selected career fields.

Research Questions/Hypotheses

The four research objectives are very broad. To evaluate each of the three career fields completely, more specific objectives are required. Therefore, a series of research questions and supporting hypotheses were formulated to systematically diagnose the selected career fields. These research questions/hypotheses are presented in detailed format in Appendix A. However, in this section they appear in matrix format (see Table 2) for ease of understanding and to aid in following the remainder of the research. The matrix is an important link between the job characteristics model offered by Hackman and Oldham, and the structured diagnostic plan which is detailed in the next chapter.

The matrix in Table 2 lists the three focal career fields in the first row and several variables, all measured by the Job Diagnostic Survey (JDS), in the first column. For each career field and variable the author proposed a statistical relationship between the JDS score for the selected career field and the JDS score for a national sample. For example, for the variable job satisfaction, the author proposed that bomb-navigation mechanics would score significantly higher than the national sample; and, aircraft maintenance specialists and munitions systems specialists would score significantly lower than the national sample. To supplement the comparison of each career field with the

national norm, hypotheses comparing the career fields with each other were also formulated and tested. These hypotheses are logical extensions of the relationships appearing in Table 2. For example, if bomb-navigation mechanics were expected to score above the national norm, while aircraft maintenance specialists, and munitions systems specialists were expected to score below the national norm, then bomb-navigation mechanics were also expected to score above the other two career fields. To avoid redundancy, the hypotheses comparing the career fields with each other are not explicity stated in this report.

These hypothesized relationships were formulated solely by the author to aid in diagnosis of each career field. They were based on personal observations of aircraft maintenance personnel during six years of flying in SAC, interviews with Air Force Human Resources Laboratory (AFHRL) personnel who have carefully studied SAC aircraft maintenance (3;4), interviews with former SAC aircraft maintenance officers (27), and the relationship between job characteristics and work outcomes proposed by Hackman and Oldham in the job characteristics model (17). In addition, the author's interpretation of data compiled by the AFHRL in a 1981 qualitative study (4) and Air Force Regulation 39-1, Airman Classification, which contains job descriptions for each career field, provided further support for the hypotheses that follow. These proposed relationships were

used to conduct statistical tests. The purpose of these statistical tests and the use of a national sample for comparison purposes is discussed in the methodology.

TABLE 2

RESEARCH HYPOTHESES - MATRIX FORMAT*
(HYPOTHESIZED RANKINGS OF SCORES RESULTING
FROM CAREER FIELD COMPARISONS)

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist
Affective Outcomes			
Job Satisfaction	Higher	Lower	Higher
Internal Work Motivation	Higher	Lower	Lower
Growth Satisfaction	Higher	Lower	Lower
Summary Measure of Job			
Motivating Potential	Higher	Lower	Lower
Job Characteristics			
Skill Variety	Higher	Lower	Lower
Task Identity	Higher	Lower	Lower
Task Significance	Higher	Higher	Higher
Autonomy	Higher	Lower	Lower
Feedback From the Job	Higher	Higher	Lower
Feedback From Agents	Higher	Higher	Higher
Dealing With Others	Higher	Higher	Higher
Context Satisfactions			
Pay Satisfaction	Lower	Lower	Lower
Security Satisfaction	Higher	Higher	Higher
Social Satisfaction	Higher	Higher	Higher
Supervisory Satisfaction	Higher	Higher	Higher
Desire For Change			
Growth Need Strength	Higher	Higher	Higher

* See Appendix A for expanded research hypotheses.

CHAPTER IV

METHODOLOGY

The purpose of this chapter is to describe how this study was performed. The Job Diagnostic Survey (JDS) is discussed in detail because of the central role it played in data collection. A brief description of the sample population and the procedures followed while administering the survey to this population demonstrates how the JDS was used to collect the data. Specific limitations of the JDS guided the data analysis and therefore warrant brief discussion. A presentation of the diagnostic plan highlights the structured procedure and analytic tools used throughout the study to answer the research objectives. In addition, the statistical methods used in the research are presented in detail to aid in replication of this study. Finally, assumptions regarding specific aspects of the research complete this section.

The Survey Instrument

The survey instrument used in this research is called the Task Characteristics and Job Attitude Questionnaire and is contained in Appendix B. The survey has two parts. The first part is the short form of the Job Diagnostic Survey developed by Hackman and Oldham (14). The responses to questions in this section were rigorously

analyzed to achieve the research objectives of this study. The second part is a series of questions designed to collect demographic data. These responses were collected primarily to serve as baseline data for similar research conducted in the future.

The JDS is a well known diagnostic instrument in the field of job redesign. It was developed over a two year period and is based on earlier research conducted by Turner and Lawrence (38), and Hackman and Lawler (13). The JDS is designed to be taken by employees who work on any given job, and measures each of the concepts specified in the job characteristics model. In addition, it quantifies several supplementary measures of the respondents' reactions to his or her work (14:5). Along with the five core job dimensions outlined in Chapter II, the JDS measures two additional dimensions found helpful in understanding jobs and employee reactions to them. These are:

> Feedback from agents: The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers. (This dimension is not, strictly speaking, a characteristic of the job itself. It is included to provide information to supplement that provided by feedback from the job itself dimension.)
>
> Dealing with others: The degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organization members and with external organizational clients.)

The JDS (long form) also measures the three psychological states which Hackman and Oldham propose to be dependent upon the five core job dimensions.

To better understand employees' attitudes about their work, the JDS measures a number of personal, affective reactions or feelings a person obtains from performing a job. These personal outcomes are listed and described below (14:6).

> General job satisfaction: An overall measure of the degree to which the employee is satisfied and happy with the job.
>
> Growth satisfaction: A measure of the degree to which the employee is satisfied with the opportunity for personal learning and growth at work.
>
> Internal work motivation: The degree to which the employee is self-motivated to perform effectively on the job--i.e., the employee experiences positive internal feelings when working effectively on the job, and negative feelings when doing poorly.
>
> Specific satisfactions: A number of short scales provide separate measures of satisfaction with:
>
> (a) job security
> (b) pay and other compensation
> (c) social aspects
> (d) supervision

Finally, the JDS measures growth need strength, an individual's desire to obtain growth satisfaction from the work

performed. This measure is viewed as a moderating variable which gives an indication of how well the individual will respond to a job which is high in motivating potential.

There are two forms of the Job Diagnostic Survey: the JDS and the JDS short form. The short form is a brief version of the JDS and takes about fifteen minutes to complete. The psychological states described as intervening variables by the theory are not measured by the short form and other scales are measured with fewer items. However, the scales measuring the job dimensions themselves are identical in both the short and long versions of the JDS. Since the short form does not create an excessive demand on the respondent's time and measures all the key variables of interest, it was used in this research (14:9). Scoring procedures for the short form are contained in Appendix C.

In general, the relationships among the JDS scales "are substantial and in the direction predicted by the theory on which the instrument is based (14:28)." Internal consistency reliabilities are generally satisfactory, and the items measuring job dimensions show adequate discriminant validity. Objectivity measures of the JDS show a moderate level of convergence and intercorrelations are generally satisfactory. For a more detailed discussion of the empirical properties of the Job Diagnostic Survey see Appendix D.

Sample Population and Survey Administration

The population for this research consisted of all SAC aircraft maintenance personnel currently assigned to one of the selected career fields serving in the continental United States (CONUS). Since, ninety percent of the available assignment locations in SAC aircraft maintenance are located in the CONUS, the exclusion of overseas SAC personnel from the sample was not considered detrimental to the research (1:100). In addition, the sample was limited to only those personnel who had achieved a skill level of three or five. The terms three-level and five-level refer to relative positions of advancement in terms of training, technical competence, leadership, and management. Maintenance personnel who have achieved a three or five-skill level are generally considered an apprentice or technician. In some cases they are just beginning to assume supervisory roles; however, for the most part their primary focus is on actual technical work. Beyond these skill levels, supervisory and managerial functions become more important and technical duties less important. Since the primary focus of this research is on the attitudes and task design of the SAC aircraft technician, those personnel most involved in performing maintenance tasks, the survey population was limited to three and five-skill level personnel (33:6-8). Out of a total three and five-skill level population of approximately 6500 personnel, two hundred airmen from each career field

were randomly selected. A survey package, containing a survey with cover letter and preaddressed return envelope, was then mailed to each individual. Some of the important procedures and considerations followed in selecting the sample and administering the JDS are discussed below:

(1) The JDS can be used for almost any kind of worker, but it is less appropriate for middle- and upper-managers whose jobs are much more strongly defined by role relationships than by specific tasks to perform (17:307). Therefore, only personnel who had achieved a three or five-skill level were administered the questionnaire. This provided a population size of nearly 6500 maintenance technicians. The duties performed by personnel above these levels were considered more supervisory oriented and more prone to be defined by role relationships than by specific tasks performed.

(2) Since the JDS results for individual respondents are almost always grouped into job categories, it was very important to insure the categories used in the study resulted in groupings of people who essentially did the same things at work. Without the consistency of these groupings it would not be possible to draw conclusions about the strengths and weaknesses of specific jobs (17:308). Therefore, each career field represented a distinct category for which data was aggregated and analyzed.

(3) When administering the JDS it is important the

respondents have a sense of privacy and know their answers will be kept confidential. Therefore, the surveys were mailed directly to the respondents. In addition, the survey cover letter advised the respondent of the survey's purpose and the strict confidentiality of the results (17:308-309).

(4) Taking the JDS should be both voluntary and anonymous. First, it is better to have no data at all from an individual than to have data from an unwilling respondent. Second, when the intent of the survey is to learn how all people who work on a given job perceive that job and react to it, there is no need to identify specific responses with individuals. Since this was the case, names were not requested and the results were reported by career field, not by individual (17:309).

Limitations of the JDS

Since originally published, the Job Diagnostic Survey has been used in many organizations and subjected to a variety of empirical tests. These studies have highlighted a number of limitations and suggest several cautions in using the instrument. Some of these are briefly discussed below.

(1) JDS measures of job characteristics are not independent of one another. For example, when a job is high in one characteristic (such as skill variety) it also tends to be high in one or more of the others (such as autonomy).

Hackman and Oldham acknowledge this limitation by observing that good jobs are generally good in a number of ways, while bad jobs generally tend to score low in most of the job characteristics. The model would be better statistically if the job characteristics were independent of one another; because they are not, the researcher must be careful not to over-interpret JDS scores of any single characteristic considered alone (17:313).

(2) Far more validity studies are needed before researchers can be sure the JDS in fact measures what it is supposed to be measuring. Therefore, when researchers use the JDS to diagnose a particular work environment, it is especially important to use more than one methodology and to check for consistency among measures before using them in planning for change. The implications of this limitation for this research are discussed in Chapter VI, Conclusions and Recommendations (17:313).

(3) The Job Diagnostic Survey is easily faked and results may be distorted by the respondents' desires to present themselves as being consistent in how they respond to various sections of the survey. Therefore, special care must be taken to ensure respondents know their best interests will be served if the data they provide accurately reflects the objective characteristics of the job and their personal reactions to them (17:314).

(4) The JDS is not appropriate for use in diagnosing

the jobs of single individuals. At least five or more individuals who work on the same job should have their responses averaged so the reliabilities of the job characteristic measures can be fully satisfactory (17:314-315).

Diagnostic Use of the JDS

Although the JDS is a multi-purpose diagnostic instrument, its primary intended use is to diagnose existing jobs to determine if (and how) job redesign might improve worker motivation, satisfaction, and productivity (17:103). The overall intent of this study was to use the JDS responses to identify any specific career field or any operational conditions which account for marginal individual motivation and satisfaction. The information obtained from this data was then used as a basis to recommend policy changes and job redesign.

This research used a diagnostic method suggested by Hackman and Oldham to examine the selected maintenance career fields (17:109-115). First, a number of specific questions to guide a step-by-step diagnosis of each career field were formulated. At each step of this diagnostic plan, the relevant JDS scores were evaluated against national norms. In addition, the JDS scores of each career field were compared with each other. The results obtained in this diagnosis were then used as a basis upon which to formulate conclusions and recommendations.

Although the national norm was only one of two methods used to evaluate the JDS responses of SAC aircraft maintenance personnel, its role in this research needs further explanation. A series of national norms were compiled by Hackman, Oldham and Stepina (18) specifically to aid in the systematic diagnosis of job design. These researchers believe the national norms serve as relatively stable baseline data with which to compare and interpret JDS responses. The largest aggregation of JDS scores compiled by Oldham, Hackman, and Stepina represent the responses of 6930 workers across 876 different jobs. This aggregation is displayed in Appendix E, but is not directly used in this research. The author agrees that comparing JDS responses with a national norm can provide important insight into what aspects of the focal job are potential problem areas. However, there is also a risk of over-simplifying the diagnosis by relying too heavily on the notion that a national norm is the only source of comparision and everything above this norm is good and everything below is bad. Therefore, this research compared the JDS responses of each maintenance career field with both a national norm, and with each other. When results of these comparisons were supportive of one another, the study acknowledged the existence of a potential weakness in job design. However, before drawing specific conclusions, the data was supplemented with the observations of others having first-hand knowledge of SAC

aircraft maintenance and the author's experience in SAC flying units.

An aggregation of 500 non-managerial respondents to the JDS were selected as the national norm used to compliment the diagnostic plan (18:23). This data is displayed in Table 3 and was compiled primarily by the Roy W. Walters consulting firm for use in organizational diagnosis. The remainder was collected by academicians from universities and research institutes throughout the United States. Hackman, Oldham, and Stepina (18) subdivided 6930 JDS responses according to a number of organizational, job, and employee characteristics. The non-managerial job characteristic was selected as the most appropriate subdivision with which to compare SAC aircraft maintenance technicians. However, other subdivisions, such as age of the respondent or organizational size, could have been used instead. Possibly a more appropriate subdivision would be one representing aircraft technicians or military personnel. However, such aggregations of the data are unavailable. Therefore, for this research, the author selected the non-managerial job characteristic as the most suitable and available national norm.

A flow chart of the sequential diagnostic plan used in this study is depicted in Figure 3 (12:84). An understanding of this process is essential to insure the success of job diagnosis and job redesign, if necessary.

TABLE 3

JOB DIAGNOSTIC SURVEY NATIONAL NORMS
NON-MANAGERIAL WORKERS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	4.30	1.28
Task Identity	4.65	1.24
Task Significance	5.39	1.15
Autonomy	4.61	1.24
Feedback from Job	4.70	1.23
Feedback from Agents	3.97	1.39
Dealing with Others	5.23	1.10
CRITICAL PSYCHOLOGICAL STATES		
Experienced Meaningfulness	5.00	.99
Experienced Responsibility	5.33	.86
Knowledge of Results	4.99	1.06
AFFECTIVE OUTCOMES		
General Satisfaction	4.58	1.08
Growth Satisfaction	4.63	1.19
Internal Work Motivation	5.47	.81
CONTEXT SATISFACTIONS		
Job Security	4.71	1.21
Pay	4.16	1.42
Co-workers	5.25	.96
Supervision	4.82	1.39
INDIVIDUAL GROWTH NEED STRENGTH	5.57	1.12
MOTIVATING POTENTIAL SCORE (MPS)	113.38	60.00

Note: These norms were compiled by Hackman, Oldham, and Stepina. They are based on the responses of 500 employees who work in non-managerial positions (18:23).

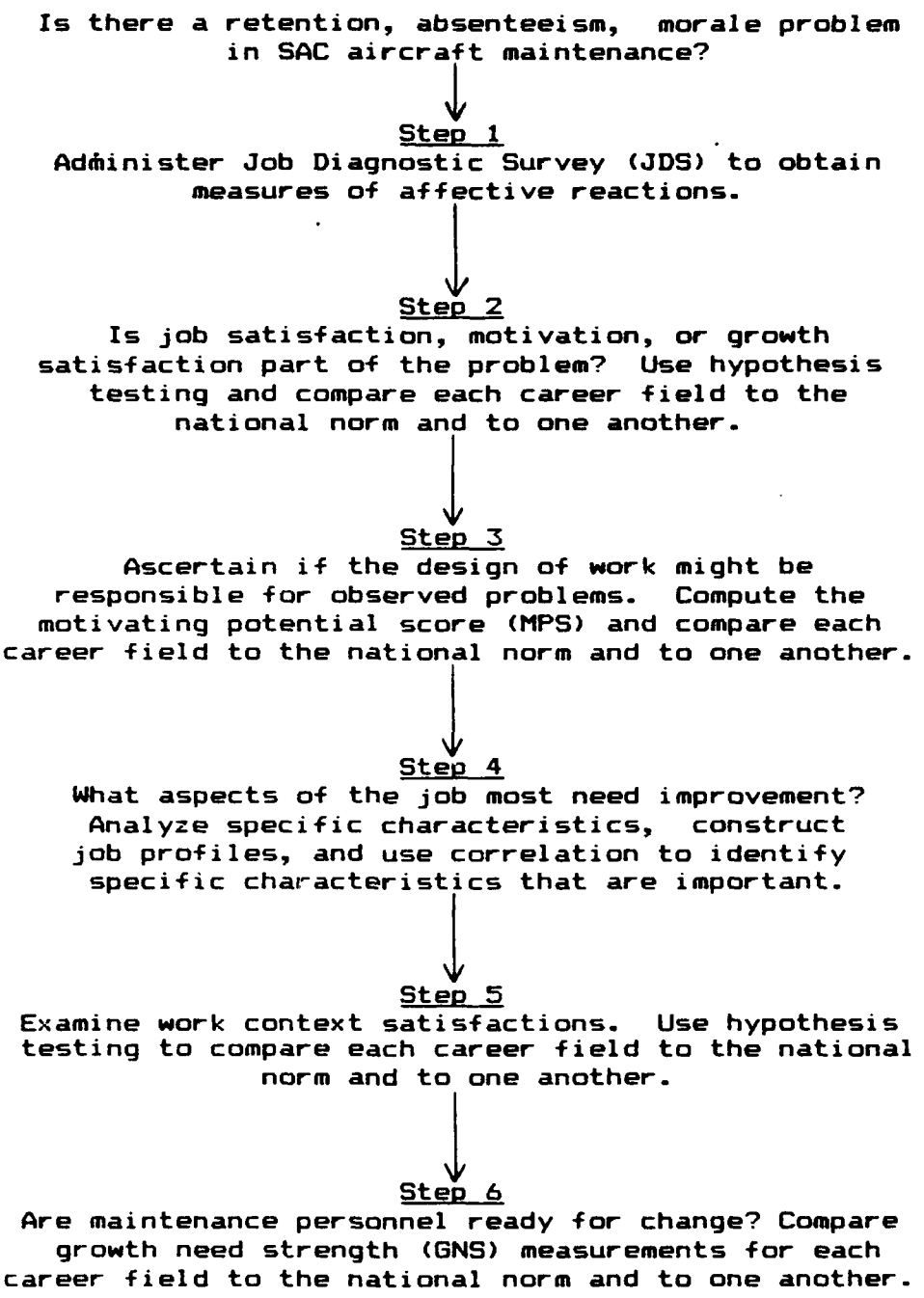


FIGURE 3

JOB DIAGNOSTIC PLAN FLOWCHART

Based on previous sources and studies cited in Chapter 1, the author perceived a problem in SAC aircraft maintenance which was causing low retention, low morale, and low motivation. To isolate the cause of this problem, the JDS was administered (Step 1) to collect both affective reactions to the job and employee reactions to the five core job dimensions. The results obtained from the survey were then used to answer the specific questions posed at each step in the diagnostic process as depicted in the flow diagram.

Step 2. Is job satisfaction, internal motivation, and growth satisfaction part of the problem? As suggested by the job characteristics model, two positive outcomes of work redesign have primarily to do with (1) the work motivation and satisfaction of employees, and (2) their performance effectiveness. Sometimes work redesign is implemented when employees are basically satisfied with their jobs and the quality of the work is acceptable. In such a case, work redesign is unlikely to help very much. Other times, there are real problems in work effectiveness, but these problems have little to do with employee motivation and are actually attributable to poor procedures and techniques, poorly designed production systems, or faulty equipment. Therefore, to help answer this question, the JDS measures of job satisfaction, internal work motivation, and growth satisfaction were aggregated for each career field

and compared to the national norm and to one another (17:109-110).

Step 3. Ascertain if the design of work might be responsible for observed problems. There are many possible reasons for poor performance, motivation, or satisfaction. Work redesign is an appropriate change strategy only if there is reason to believe observed problems may have their roots in the motivational properties of the work itself.

One indication of such motivational properties is the motivating potential score (MPS) provided by the JDS. By comparing the MPS of the selected career fields with national norms and with each other, the relative degree of motivating potential in the focal job can be assessed. If MPS is low, then it is reasonable to conclude that the work itself may be contributing to the performance, motivation, or satisfaction problem previously documented. Therefore, more rigorous analysis is needed. However, if the MPS is high, then it is advisable to look at other aspects of the work context as a possible cause of observed difficulties. Indications of problems in these areas can be obtained by examining the scores for job security, pay, supervisory satisfaction, and social satisfaction which are also measured by the JDS. As in Step 2, hypothesis tests of mean motivating potential scores were used to assess the relative strengths or weaknesses of focal jobs. The test results directed the next step in the diagnostic process (17:111).

Step 4. What aspects of the job most need improvement? In order to pinpoint the specific strengths and weaknesses of a job, examination of the job in more detail is necessary. This step involves a detailed analysis of the five core job dimensions specified by Hackman and Oldham in the job characteristics model. This analysis is necessary because jobs that may be nearly identical in MPS can require quite different changes if they are to be motivationally improved. It is not enough to know that a job is low in motivating potential. The researcher also must identify what it is about the job that most needs to be improved and confirm this assessment by making sure those who perform the job and those who supervise it are in rough agreement about its best and worst features (17:111-115).

To accomplish this step, several analytical tools were used. Hypothesis tests were used to isolate specific dimensions of the job which appeared low. This testing involved comparing career field responses with both national norms and with each other. Then, job profiles were constructed for each career field. The purpose of each job profile was to make visually apparent where improvements may need to be made. An illustrative profile of a sample job and the national norm is shown in Figure 4. Finally, correlation analysis was performed to isolate those job characteristics which most contributed to the affective measures of job satisfaction, internal motivation, and

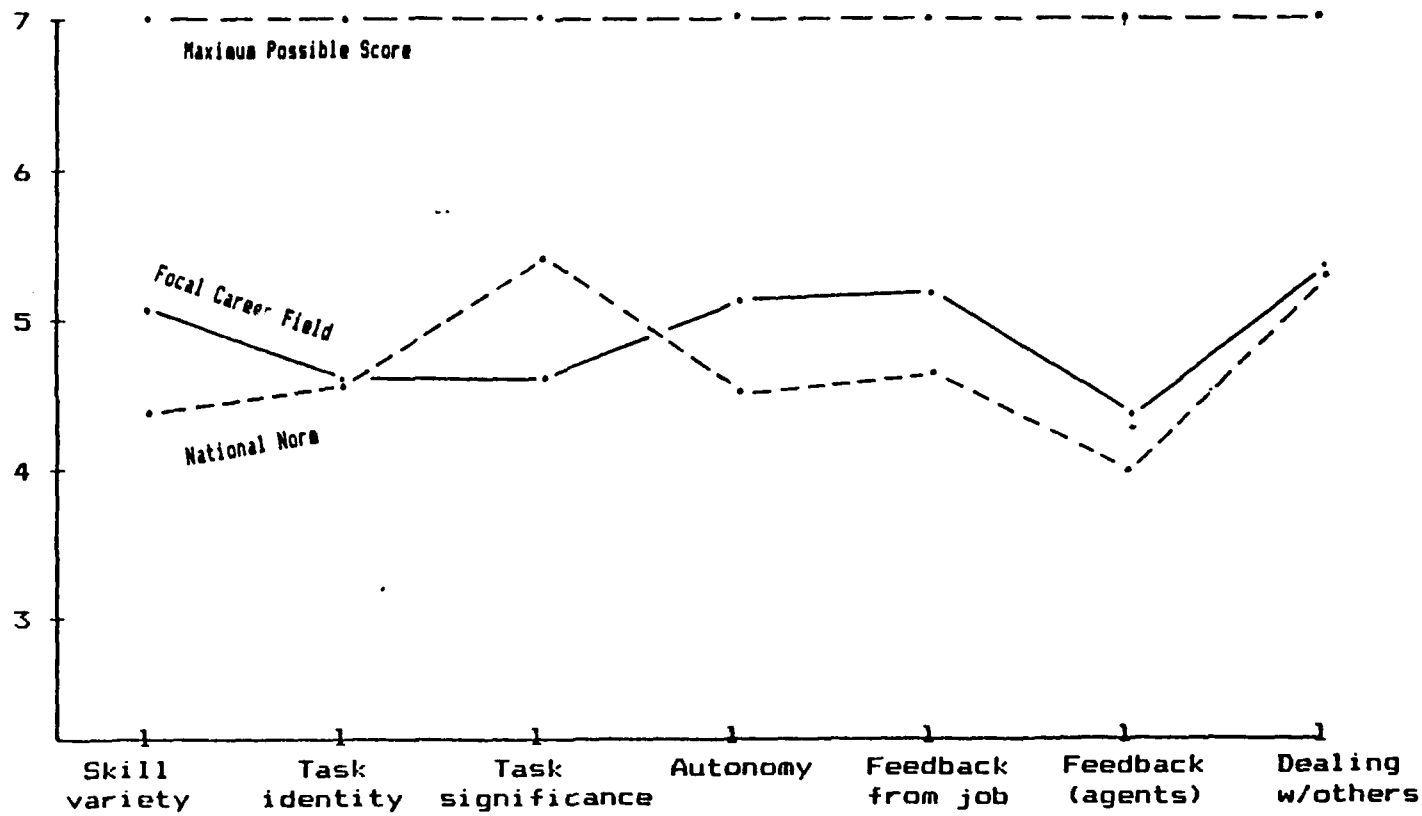


FIGURE 4

ILLUSTRATION OF JOB DIAGNOSTIC JOB PROFILE

growth satisfaction tapped by the JDS. The purpose of this analysis was to help prioritize the job core dimensions as an aid to tailoring an effective job redesign program for a particular career field.

Step 5: Examine work context satisfactions. The JDS context satisfaction measures are useful indicators of the degree to which job incumbents may be preoccupied with problems of pay, job security, co-worker relationships, and supervision. When these problems exist, the worker is unable to exploit opportunities for growth and personal development in the job. These satisfactions are only briefly measured by the JDS, but do capture the potential for possible problems in the work context. When combined with the more detailed measures of work design, they help present a complete picture of the work environment and therefore enhance the diagnostic procedure. As in the previous steps, hypotheses were used to compare responses with the national norm and between career fields in order to isolate potential problems areas.

Step 6: Are maintenance personnel ready for change? The final step in the diagnostic plan is to assess whether personnel in each career field are ready for change, if the diagnosis to this point shows job redesign is a valid strategy. The tool for measuring this readiness for change is growth need strength. A relatively high score for growth need strength may indicate employees will react very favor-

ably to work redesign. However, even a relatively low growth need strength score does not ensure a person will react unfavorably to enriched work. A low expressed need for growth may be interpreted as a lack of growth opportunities in past work experiences. Therefore, one might be advised to proceed cautiously with job redesign in hopes of rekindling this growth motivation.

Growth need strength is but one measure of how job redesign will be received by the focal organization. Other key factors must be considered, as well, before such a program is implemented. First, does the individual have the task-relevant knowledge and skills to operate effectively in an enriched work situation? If the answer here is no, retraining may have to precede any effort to enrich the work. In addition, is the organization suitable for such a change program? To answer this question, such aspects as the hospitability of the organization to needed changes and the structure of the organization's technological, personnel, and control systems must be considered. These issues are beyond the measurement capabilities of the JDS, but are obviously important factors.

Statistical Analysis

A wide variety of statistical tools are available for analyzing behavioral data. In this study, two of these tools: large-sample hypothesis testing of means and

Pearson's correlation analysis were used at each step of the diagnostic plan outlined earlier. The large-sample hypothesis testing of means was used in conjunction with steps 2 through 6 of the diagnostic plan to conduct tests of the proposed relationships. Correlation analysis was used in conjunction with step 4 to prioritize those aspects of the job that most influence job satisfaction, internal work motivation, and growth satisfaction. The results of each analysis served as the basis for the next step in the diagnostic plan. All data analyses were performed using the Statistical Package for the Social Sciences (SPSS) (Version 8.3 -- May 4, 1982) program developed by Northwestern University.

Comparison of means. Hypothesis testing to support the research questions and the diagnostic plan was conducted by comparing the sample means (23). To accomplish this, the sample means and standard deviations were computed using Subprogram FREQUENCIES. Then the sample mean was manually compared to the normative data (non-managerial) reported by Hackman, Oldham, and Stepina (18:23). For each hypothesis test conducted in Chapter V, Data Analysis, the following systematic approach was used to test for differences in mean responses:

1. Compute sample mean and standard deviation of key variable being tested using SPSS. Since the sample size, n, was greater than 30 in all cases, the computed value of the sample variance, s^2, was assumed to be a sufficiently reliable estimate of the population variance, σ^2.

2. State both a null hypothesis (Ho) and an alternative hypothesis (Ha) in the following form:

$$Ho: \quad u_1 = u_2$$

$$Ha: \quad u_1 > u_2 \text{ or } u_1 < u_2$$

The null hypothesis was always stated to reflect no difference between the sample means. The alternative hypothesis was stated to reflect a positive or negative relationship between the means being tested.

3. Specify a significance level for the test. In all cases the tests were one-tail tests with a significance level of .05. This resulted in a critical Z-value of 1.64. This significance level represented the smallest probability accepted as reasonable due to chance.

4. Compute the standard deviation of the sampling distribution using the formula:

$$\sigma_{(\bar{x}_1 - \bar{x}_2)} = \sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}$$

5. Compute the Z-statistic (test statistic) using the following formula:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sigma_{(\bar{x}_1 - \bar{x}_2)}}$$

6. Compare the test statistic with previously established critical value for Z, which was 1.64, to determine if a significant difference between population means actually existed.

In this study, the samples were independent. Therefore, cases were classified by career field and each career field's mean for the specified variable was tested against both the national norm and the other two career fields.

The following assumptions applied throughout this phase of the statistical analysis:

1. The four samples involved (three career fields and national norm) were randomly selected in an independent manner from the target population.

2. All sample sizes were large enough so that $\bar{X}_1$ and $\bar{X}_2$ each had approximately normal sampling distributions and $(s_1)^2$ and $(s_2)^2$ provide good approximations of $(\sigma_1)^2$ and $(\sigma_2)^2$. This is generally considered true when $n > 30$.

3. The sampling distribution of $(\bar{X}_1 - \bar{X}_2)$ is approximately normal for large samples.

Correlations. The term correlation implies a relationship between two variables. In step 4 of the diagnostic plan, the Pearson product moment coefficient of correlation, r, was computed using SPSS subprogram, PEARS CORR. The value computed was a measure of the strength of the linear relationship between the specified variables (23:418). In this research, the primary linear relationships of concern involved one of the key work outcomes (job satisfaction, internal work motivation, or growth satisfaction) and the key job dimensions/work context factors measured by the JDS. A value of r near or equal to zero implied little or no linear relationship between the variables being compared. In contrast, the closer r was to 1 or -1, the stronger the linear relationship. Positive values of r implied that JDS measures of the variables being compared tended to move in the same direction. Negative values of r implied that the values moved in opposite directions.

Research Assumptions

The following assumptions were used throughout this research. Although these assumptions may have limited and conditioned some aspects of the research, they were not viewed as adversely affecting the research findings.

General. The assumptions which applied to the overall conduct of this research were as follows (12:7):

1. The principles of motivation and job enrichment apply equally to the Air Force and to civilian organizations within which the original theory was developed. This assumption is valid given the successful results of job enrichment within the Air Force Logistics Command.

2. The job characteristics model is an accurate representation of the relationship between job core dimensions, and the employee's job satisfaction, internal work motivation, and growth satisfaction. Although the five core job dimensions may not represent an exhaustive listing, the chosen dimensions are significantly predictive and influential in determining the specified work outcomes.

3. While trend data would make this study more valuable, the collection of data on a one time basis can still be usefully analyzed.

Methodology. The assumptions which condition the methodology used in this study were as follows (12:8):

1. The methodology used in this research to diagnose jobs provides an effective and validated method of identify-

ing and ranking motivational dimensions.

2. The Job Diagnostic Survey is a valid instrument for use in the SAC aircraft maintenance environment to measure job characteristics and affective reactions to jobs. In addition, the empirical properties of the JDS are satisfactory for this research.

3. Due to the guarantee of anonymity, the sample responses were unbiased.

Summary

The goal of this methodology was to reduce the risks of intuition. Too often, managers determine the need for job enrichment based on intuition or implicit diagnosis of the work environment. This results in the manager deciding what "seems right" for a given job and then proceeding to install some changes intended to improve that job. However, this diagnosis can often be flawed, leading to inappropriate changes which remedy only symptoms and fail to address the problems. The methodology presented in this chapter serves to reduce the role of intuition by specifying an objective procedure for the collection of data and a systematic approach for the analysis of that data.

However, there are problems with every methodology used to assess jobs and people's reactions to them. According to Hackman and Oldham (17:102), many of these problems can be minimized "only by using multiple method-

ologies involving data from multiple observers" using multiple instruments. For example, if data is initially collected using a questionnaire, it might be supplemented with interviews. In addition, multiple observations including both the employees who occupy job positions and managers who are not personally involved in the focal job should be used as sources of data. When all interested parties agree that the diagnostic data provides a reasonably accurate assessment of the work situation, the resulting plan for the redesign of work has a much better chance of success. As such, the data analysis that follows represents one observer (the maintenance technician) and one source (the Job Diagnostic Survey). Therefore, it provides important information regarding the attitudes of focal employees to their work which when combined with data collected from other sources increases the likelihood of a successful job redesign program.

CHAPTER V

DATA ANALYSIS

The results of the sample survey are presented in six sections corresponding to the steps outlined in the methodology. The first section summarizes the survey response rates and demographic data for the survey respondents. Section two analyzes the self-reported job satisfaction, internal work motivation, and growth satisfaction of personnel assigned to the selected career fields. Section three focuses on the design of work as an important factor in the attitudes of employees by comparing composite motivating potential scores. Section four goes one step further by individually assessing key job dimensions, some of which are components of the composite motivating potential score. Section five reviews technicians' attitudes regarding work context factors, such as pay, social factors, supervisory satisfaction, and job security. These factors add important insight to the overall analysis of work design in the selected career fields. Finally, section six examines employee's attitudes about enriched work as a means of assessing their readiness for a work redesign effort. The sum total of this analytical effort provides needed insight for the conclusions and recommendations that follow in Chapter VI.

Step 1: Survey Response Rate and Population Characteristics

As previously stated in the methodology, a total of 600 surveys were mailed to aircraft maintenance personnel in SAC, two hundred to each career field. The survey response rates appear in Table 4. The response rates for bomb-navigation systems mechanics and munitions systems specialists were nearly equal. However, the response rate for airlift/bombardment aircraft maintenance personnel was low in comparison to the other two career fields.

TABLE 4

SURVEY RESPONSE RATE

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Number of surveys mailed.....	200	200	200	600
Total number returned.....	129	96	126	351
Percent return rate.....	64.5	48.0	63.0	58.5
Number returned unusable.....	8	7	4	19
Total usable returned.....	121	89	122	332
Percentage usable returned.....	60.5	44.5	61.0	55.3

Demographic data on the survey respondents was also computed and appears in Table 5. The typical survey respondent had achieved the rank of E-3 or E-4, had between one and four years of active duty service, and was between the ages of 21 and 25. The vast majority of respondents were high school graduates and a large number had also

TABLE 5

DEMOGRAPHIC DATA*

a) Present Active Duty Grade (Number (Percentage))

Grade	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
E-1	0(0)	0(0)	1(.008)	1(.003)
E-2	5(.041)	3(.034)	10(.082)	18(.054)
E-3	65(.537)	49(.551)	40(.328)	154(.464)
E-4	28(.231)	20(.223)	41(.336)	89(.268)
E-5	23(.190)	17(.191)	28(.230)	68(.205)
E-6	0(0)	0(0)	2(.016)	2(.016)
E-7	0(0)	0(0)	0(0)	0(0)
E-8	0(0)	0(0)	0(0)	0(0)
	121	89	122	332

b) Total Active Federal Military Service

Years Service	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Less than 1 yr	4(.033)	2(.023)	11(.090)	17(.053)
1-4 years	84(.694)	64(.719)	62(.508)	210(.633)
5-8 years	27(.223)	17(.191)	38(.311)	82(.255)
9-12 years	5(.041)	6(.067)	9(.074)	20(.062)
13-16 years	0(0)	0(0)	1(.008)	1(.031)
Over 16 years	1(.008)	0(0)	1(.008)	2(.006)
	121	89	122	332

c) Age

Age	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
20 or under	16(.132)	9(.101)	23(.189)	48(.145)
21-25 years	73(.603)	64(.719)	75(.615)	212(.639)
26-30 years	28(.231)	14(.157)	18(.148)	60(.181)
31-35 years	3(.025)	2(.022)	4(.033)	9(.027)
36-40 years	1(.008)	0(0)	2(.016)	3(.009)
41-45 years	0(0)	0(0)	0(0)	0(0)
	121	89	122	332

* Table 5 is continued on pages 74 and 75.

TABLE 5
(CONTINUED)

d) Highest education level

Level	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Grade School	0(0)	0(0)	0(0)	0(0)
Some High School	1(.008)	4(.045)	4(.033)	9(.027)
High School Grad	47(.388)	50(.562)	78(.640)	175(.527)
Some College	69(.570)	33(.371)	39(.320)	141(.425)
College Grad	3(.025)	1(.011)	0(0)	4(.012)
Some Grad Work	0(0)	0(0)	0(0)	0(0)
Graduate Degree	1(.008)	1(.011)	1(.008)	3(.009)
	121	89	122	332

e) Sex

Sex	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Male	112(.926)	84(.944)	118(.967)	314(.946)
Female	9(.074)	5(.056)	4(.033)	18(.054)
	121	89	122	332

f) Marital Status

Status	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Married	56(.463)	46(.517)	70(.574)	172(.518)
Single	65(.537)	43(.483)	52(.426)	160(.482)
	121	89	122	332

g) Skill level

Skill level	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
3-level	33(.272)	4(.045)	18(.148)	55(.166)
5-level	88(.727)	85(.955)	104(.852)	277(.834)
	121	89	122	332

TABLE 5
(CONTINUED)

h) Supervisory/Non-Supervisory Status

Status	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Supervisor	49(.405)	43(.483)	60(.492)	152(.458)
Non-supervisor	72(.595)	46(.517)	62(.508)	180(.542)
	121	89	122	332

i) Career Intent

Intent	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Separate	15(.124)	15(.169)	23(.189)	53(.160)
Retire	1(.008)	0(0)	1(.008)	2(.006)
Undecided	65(.537)	34(.382)	46(.377)	145(.437)
Stay	40(.331)	40(.449)	52(.426)	132(.398)
	121	89	122	332

j) Present job a factor in career intent decision (Separate and Undecided responses to item i)

Factor	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	Total
Yes	47(.588)	27(.551)	37(.536)	111(.561)
No	33(.412)	22(.449)	32(.464)	87(.439)
	80	49	69	198

completed some college work. Nearly all the respondents were male and there was roughly an even split between married and single. The majority of respondents were five-levels and over half held non-supervisory positions. Finally, in terms of career intent, the majority of bomb-nav mechanics were undecided as to a future career in the Air Force, whereas a majority of aircraft maintenance specialists and munitions systems personnel responded they were planning to stay in the Air Force.

One purpose of the demographic data was to assess whether the three sub-groups exhibited similar characteristics so that further statistical comparisons would be meaningful. Although there were minor differences across career fields, these were not considered significant enough to cause problems with further statistical analysis. Therefore, the author concluded for comparative purposes, the three career fields were equally matched.

Step 2: Job Satisfaction, Internal Work Motivation, and Growth Satisfaction

This section compares the degree of job satisfaction, internal work motivation, and growth satisfaction of the selected career fields as reported in the Job Diagnostic Survey (JDS) portion of the questionnaire. The hypotheses presented in Chapter III and Appendix A were used as a basis for conducting significance tests on the data.

Job satisfaction. The first three hypotheses dealt with the job satisfaction of personnel in the three career fields. The hypotheses tested reflected the author's belief that the job satisfaction of bomb-navigation mechanics would be significantly higher than both the national norm and the other two career fields. In addition, the other two career were hypothesized to have low job satisfaction when compared to the national norm.

The results are depicted in Table 6. The format and type of information shown in this table is used throughout the data analysis. The mean score for each career field is listed along with its standard deviation. The mean score for the selected national norm is also shown. The three columns under the z-score heading present the results of the statistical testing. The first column lists the computed z-score for each career field as it compared to the national norm. The next column reflects the z-score when bomb-navigation mechanics and aircraft maintenance specialists; and, aircraft maintenance specialists and munitions systems specialists were compared to each other. Finally, the last column shows the z-score computed when bomb-navigation mechanics were compared to munitions systems specialists. As the table shows, the mean level of job satisfaction among bomb-navigation mechanics was significantly higher than the national norm. However, the mean level of job satisfaction among aircraft maintenance specialists and munitions systems

specialists did not deviate significantly from this norm. In addition, the mean level of job satisfaction for bomb-navigation mechanics was higher than the other two career fields, but this difference was not at the .05 significance level.

TABLE 6

JOB SATISFACTION MEAN SCORES BY CAREER FIELD AND STATISTICAL COMPARISONS

Career Field	Mean Score/ Std. Dev.	Z-values 1	2	3
Bomb-Navigation Mechanic (121)	4.95/1.18	3.15*	1.55	1.42
Aircraft Maintenance (89)	4.64/1.60	.340	-.326	
Munitions Specialist (122)	4.71/1.45	.932		
National Norm (500)	4.58/1.08			

* means value has one-tail significance level of .05

Internal work motivation. The next set of hypotheses concerned self-reported levels of internal work motivation. The hypotheses tested were similar to those tested for job satisfaction. Bomb-navigation mechanics were expected to report high levels of internal work motivation when compared to both the national norm and to the other career fields. Aircraft maintenance and munitions specialists were hypothesized as reporting low internal work motivation compared to the national norm.

The results are depicted in Table 7. The mean level of internal work motivation reported by bomb-navigation mechanics was significantly higher than the national norm. In contrast, the mean level of internal work motivation reported by aircraft maintenance personnel and munitions systems specialists did not significantly vary from the national norm. As with job satisfaction, the self-reported internal work motivation of bomb-navigation mechanics was higher than both of the other career fields. This difference was statistically significant.

TABLE 7

INTERNAL WORK MOTIVATION MEAN SCORES BY CAREER FIELD AND STATISTICAL COMPARISONS

Career Field	Mean Score/ Std. Dev.	Z-values 1	2	3
Bomb-Navigation Mechanic (121)	5.83/.864	4.20*	2.12*	3.19*
Aircraft Maintenance (89)	5.52/1.16	.391	.401	
Munitions Specialist (122)	5.46/.941	-.162		
National Norm (500)	5.47/.810			

* means value has one-tail significance level of .05

Growth satisfaction. The final set of hypotheses in this step of the diagnostic plan concern growth satisfactions of personnel assigned to the selected career fields. The hypotheses tested were identical to the

relationships specified for job satisfaction and internal work motivation.

The results are depicted in Table 8. The mean level of growth satisfaction in all three career fields was consistent with the findings reported regarding job satisfaction and internal work motivation. The bomb-navigation mechanics were significantly higher in self-reported growth satisfaction than both the national norm and the other two career fields. Both the aircraft maintenance specialists and munitions systems specialists did not deviate significantly from the national norm nor did they deviate significantly from one another.

TABLE 8

GROWTH SATISFACTION MEAN SCORES BY CAREER FIELD AND STATISTICAL COMPARISONS

Career Field	Mean Score/ Std. Dev.	Z-values 1	2	3
Bomb-Navigation Mechanic (121)	5.00/.981	3.60*	1.90*	1.83*
Aircraft Maintenance (89)	4.68/1.35	.328	-.154	
Munitions Specialist (122)	4.71/1.45	.932		
National Norm (500)	4.63/1.08			

* means value has one-tail significance level of .05

This completes step 2 of the diagnostic plan. The next step in the plan examines the design of work through

the motivating potential score of the job.

Step 3: The Design of Work

The intent of this portion of the data analysis is to measure the motivating potential of work performed by personnel in the selected career fields. The motivating potential score (MPS) is a composite index of the five core job dimensions specified by the job characteristics model and measured by the JDS. The hypothesized relationships tested were that bomb-navigation specialists would be significantly higher than both the national norm and the other two career fields. The survey results for aircraft maintenance specialists and munitions systems specialists were expected to be significantly lower than the national norm.

The results of this analysis are depicted in Table 9. The mean composite motivating potential score of bomb-navigation system mechanics was significantly higher than the national norm and significantly higher than both the scores recorded for aircraft maintenance specialists and munitions systems specialists. The mean composite motivating potential scores of aircraft maintenance specialists and munitions systems specialists were below the national norm; however, these negative deviations were not significant. The large differences in scores between the career fields suggests more detailed analysis would be beneficial.

TABLE 9

MEAN COMPOSITE MOTIVATING POTENTIAL SCORE BY CAREER FIELD AND STATISTICAL COMPARISONS

Career Field	Mean Score/ Std. Dev.	Z-values 1	2	3
Bomb-Navigation Mechanic (121)	133.16/55.86	3.44*	3.12*	2.78*
Aircraft Maintenance (89)	108.32/57.71	-.758	-.426	
Munitions Specialist (122)	111.89/63.37	-.235		
National Norm (500)	113.38/60.00			

* means value has one-tail significance level of .05

Step 4: What Aspects of the Jobs Most Need Improvement?

This section represents the focal point of job redesign; namely, identifying those specific job characteristics most in need of improvement. This analysis was divided into three sub-sections as specified by the methodology presented in Chapter IV. First, key job dimensions were statistically compared to the national norms amd with one another using hypotheses tests. Then, job profiles of each career field were constructed to visually depict the statistical comparisons previously accomplished. Finally, correlation analysis was performed to identify key job dimensions most closely related to job satisfaction, internal work motivation, and growth satisfaction.

Step 4a: Hypothesis tests on key job dimensions.

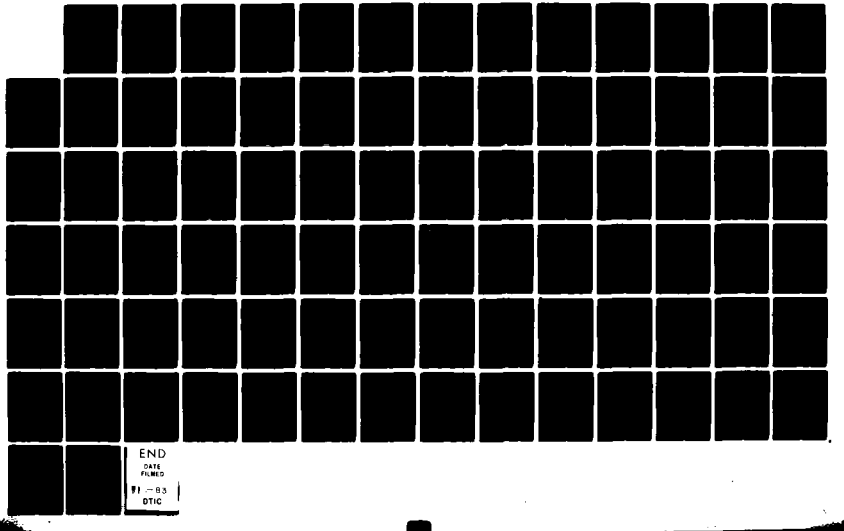
This section contains survey results for the five core job dimensions specified in the job characteristics model and two additional dimensions: feedback from agents and dealing with others. The numerical results for this section are depicted in Table 10 and are referred to frequently. This table shows mean scores and standard deviations for key variables. In addition, three sets of z-values are presented. The first row of z-values compares each career field with the national norm. The second row compares bomb-navigation mechanics with aircraft maintenance specialists, and aircraft maintenance specialists with munitions systems specialists. The final row compares bomb-navigation mechanics with munitions systems specialists.

Skill variety was the first core job dimension analyzed. The rationale for the hypothesized relationship was that bomb-navigation system mechanics perform work complex in nature and challenging to the technician's skills and maintenance abilities. In contrast, the tasks performed by the other two career fields involve a large number of tasks which are more repetitive and simple. Therefore, the technician is less challenged by the work. The hypothesis testing in this section was consistent with these relationships. Bomb-navigation mechanics were expected to report significantly higher skill variety than the national norm and the other two career fields. Aircraft maintenance

AD-A134 337 AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO SELECTED STRATEGIC AIR..(U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. C F FLYNN

UNCLASSIFIED SEP 83 AFIT-LSSR-17-83 F/G 15/5 NL

2/2



END

DATE FILMED

11-83

DTIC

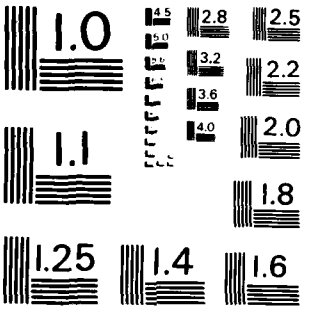


TABLE 10

MEAN SCORES OF KEY JOB DIMENSIONS AND STATISTICAL COMPARISONS**

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	National Norm
Skill Variety				
Mean	5.63	4.42	4.14	4.30
Std Dev	1.13	1.42	1.29	1.28
Z-value (Norm)	11.31*	.745	-1.23	
Z-value	6.64*		1.47	
Z-value	9.58*			
Task Identity				
Mean	5.39	5.04	5.07	4.65
Std Dev	.975	1.15	1.37	1.24
Z-value (Norm)	7.06*	2.88*	3.07*	
Z-value	2.32*		-.173	
Z-value	2.10*			
Task Significance				
Mean	6.14	6.20	6.04	5.39
Std Dev	.935	1.02	.955	1.15
Z-value (Norm)	7.55*	6.93*	6.29*	
Z-value	-.436		1.16	
Z-value	.825			
Autonomy				
Mean	4.39	3.99	4.32	4.61
Std Dev	1.19	1.47	1.41	1.24
Z-value (Norm)	-1.80*	-5.23*	-2.10*	
Z-value	2.11*		-1.64*	
Z-value	.418			

* means value has one-tail significance level of .05

** Table 10 is continued on page 85.

TABLE 10
(CONTINUED)

	Bomb-Nav. Mechanic	Aircraft Maintenance	Munitions Specialist	National Norm
Job Feedback				
Mean	5.16	4.89	4.71	4.70
Std Dev	1.14	1.12	1.13	1.23
Z-value (Norm)	3.91*	1.44	.086	
Z-value		1.71*	1.15	
Z-value		3.09*		
Feedback (Agents)				
Mean	4.24	4.04	4.35	3.97
Std Dev	1.37	1.63	1.61	1.39
Z-value (Norm)	1.94*	.366	2.39*	
Z-value		.939	-1.37	
Z-value		-.574		
Dealing With Others				
Mean	5.42	5.89	5.98	5.23
Std Dev	1.03	1.01	.846	1.10
Z-value (Norm)	1.81*	5.62*	8.25*	
Z-value		-3.30*	-.684	
Z-value		-4.63*		

* means value has one-tail significance level of .05

specialists and munitions systems specialists were expected to report similar levels of skill variety, and both were expected to be below the national norm.

The actual results supported these relationships. The degree of skill variety reported by bomb-navigation mechanics was significantly higher than both aircraft maintenance specialists and munitions systems specialists. In addition, the level of skill variety was significantly higher than the national norm. The other two career fields did not differ significantly from the national norm. However, the level of skill variety of aircraft maintenance specialists was 1.47 standard deviations higher than munitions specialists.

Task identity was the second core job dimension tested. The degree of task identity was hypothesized as high in all three career fields. When a bomb-navigation mechanic completes repair work on a component he often bench tests the unit or installs it in an aircraft. This leads to the feeling of having accomplished a complete piece of work. The aircraft maintenance specialist prepares the aircraft and insures it is operationally ready for flight. His work begins well before the crew arrives and doesn't end until after the aircraft is airborne. He too experiences the feeling of having completed an entire task. Similarly, the elements involved in performing the job of a munitions systems specialist involves the entire spectrum of duties,

including receipt, inspection, storage, maintenance, and delivery of weapons. This contributes to the feeling of having completed a "whole" piece of work.

The anticipated relationships were supported by the data. All three career fields scored significantly above the national norm in terms of task identity. In addition, bomb-navigation mechanics scored significantly higher than aircraft maintenance specialists and munitions systems specialists. The data indicate task identity is a strong point in all three of the career fields.

The third core job dimension examined was task significance. All three career fields perform work vital to the conduct of the Air Force mission. The author believes these personnel recognize this aspect of their work and perceive their jobs as significant. A set of hypotheses supporting this view of task significance in aircraft maintenance was tested.

The claim that task significance is high in the three career fields was supported. Each career field reported a level of task significance significantly higher than the national norm. In addition, the career field did not differ significantly in their self-reported task significance.

Autonomy was the fourth core job dimension tested. Due to the complexity of the systems and the "troubleshooting" nature of their work, opportunity for

independent thought and action would seem quite likely for bomb-navigation mechanics. In contrast, the work of aircraft maintenance personnel was perceived by the author to be more repetitive and systematic. This work calls for more widespread use of checklists and standardized procedures for preparing an aircraft for flight, which leads to less opportunity for worker freedom in accomplishing work tasks. Finally, the most regulated of the three career fields would be the munitions systems personnel. The very nature of the work involves receipt, inspection, storage, maintenance, and assembly of weapons. The sensitive nature of this work requires strict procedural guidelines. Therefore, the hypotheses tested reflected the belief that bomb-navigation mechanics would have high levels of autonomy and aircraft maintenance specialists and munitions systems specialists would have low levels of autonomy.

The reported levels of automony were different than originally hypothesized. All three career fields scored significantly lower in autonomy than the national norm. In addition, aircraft maintenance specialists scored significantly below bomb-navigation mechanics and munitions systems specialists. The degrees of autonomy for bomb-navigation mechanics and munitions systems specialists were roughly equal.

The final core job dimension analyzed was <u>feedback from the job</u>. The bomb-navigation system mechanic has the

opportunity to test the equipment he has been "trouble-shooting", thereby obtaining a measure of how effective his performance has been. The aircraft maintenance specialist is normally involved in a variety of tasks aimed at ensuring the aircraft gets airborne. The fact the aircraft does or does not launch successfully provides immediate feedback on performance. Therefore, both of these career fields should score high in degree of job feedback. In contrast, the munitions system specialist performs tasks not conducive to immediate feedback. Therefore, bomb-navigation mechanics and aircraft maintenance specialists were expected to report high levels of job feedback when compared to both the national norm and to munitions systems specialists. In contrast, munitions systems specialists were expected to report feedback levels significantly lower than the national norm.

The results show bomb-navigation system mechanics perceive a significantly higher degree of feedback from their jobs than the national norm. However, both aircraft maintenance specialists and munitions system specialists did not deviate significantly from the national norm. In addition, the job feedback of bomb-navigation mechanics was significantly higher than both of the other career fields.

Two additional measures, not directly related to work design, are <u>feedback from agents</u> and <u>dealing with others</u>. Both of these constructs are measured by the JDS.

Feedback from agents is the amount of feedback from supervisors and co-workers. This should not vary from career field to career field. All three career fields require close cooperation, coordination, and teamwork. Therefore, the hypotheses tested reflected the author's belief that feedback from agents would be significantly higher for all three career fields than the national norm.

The results did not completely support this perception. Both the bomb-navigation mechanics and the munitions systems specialists were significantly higher than the national norm. In contrast, the aircraft maintenance specialists did not vary significantly from the national norm. When statistically compared to each other, the three career fields did not differ significantly.

The final dimension discussed in the analysis of specific job characteristics is dealing with others. This construct represents the final diagnostic measure pertaining primarily to the job itself. The nature of aircraft maintenance requires close cooperation within and across maintenance squadrons. Therefore, the opportunity and necessity of dealing with other people is a key feature in all three career fields. Therefore, the extent to which the career fields involved dealing with others was not expected to vary between career fields, but all were expected to be above the national norm.

The results supported the above relationship for the

most part. All three career fields scored significantly higher than the national norm. However, when compared to each other, bomb-navigation mechanics scored significantly lower than aircraft maintenance specialists and munitions systems specialists.

To this point in the data analysis, eleven constructs relating to either work outcomes or specific job dimensions have been evaluated for each career field. A summary of hypothesis tests listing the results of this evaluation appears in Table 11. Another summary tool is the job profiles which are presented now to further illustrate the results.

Step 4b: Job profiles. The above findings are visually depicted for each career field in Figures 5 through 7. The job profiles compare each career field with the national norm and reinforce the results obtained through hypothesis testing. In addition, Figure 8 displays the job profiles of the three career fields on one graph for comparison purposes. These job profiles represent another tool for assessing the need of work redesign. The implications of these job profiles will be discussed in more detail in Chapter VI, Recommendations and Conclusions.

Step 4c: What aspects of the job are most important in determining job satisfaction, internal work motivation, and growth satisfaction? The intent of this section was to highlight those factors most highly corre-

TABLE 11

RESULTS TABLE OF HYPOTHESES
TESTED IN STEPS 2 THROUGH 4*

(A) Career Fields Compared With National Norm

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist
Job Satisfaction	Significantly High	Not Significant	Not Significant
Internal Motivation	Significantly High	Not Significant	Not Significant
Growth Satisfaction	Significantly High	Not Significant	Not Significant
Motivating Potential (MPS)	Significantly High	Not Significant	Not Significant
Skill Variety	Significantly High	Not Significant	Not Significant
Task Identity	Significantly High	Significantly High	Significantly High
Task Significance	Significantly High	Significantly High	Significantly High
Autonomy	Significantly Low	Significantly Low	Significantly Low
Feedback from the Job	Significantly High	Not Significant	Not Significant
Feedback from Agents	Significantly High	Not Significant	Significantly High
Dealing with Others	Significantly High	Significantly High	Significantly High

* Table 11 is continued on page 93.

TABLE 11
(CONTINUED)

(B) Career Fields Compared With Each Other

1. Job Satisfaction: No statistically significant differences between career fields.

2. Internal Job Motivation: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

3. Growth Satisfaction: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

4. Motivating Potential Score: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

5. Skill Variety: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

6. Task Identity: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

7. Task Significance: No statistically significant differences between career fields.

8. Autonomy: Aircraft Maintenance Specialists were significantly lower than the other two career fields.

9. Job Feedback: Bomb-Navigation Mechanics were significantly higher than the other two career fields.

10. Feedback From Agents: No statistically significant differences between career fields.

11. Dealing With Others: Bomb-Navigation Mechanics were significantly lower than the other two career fields.

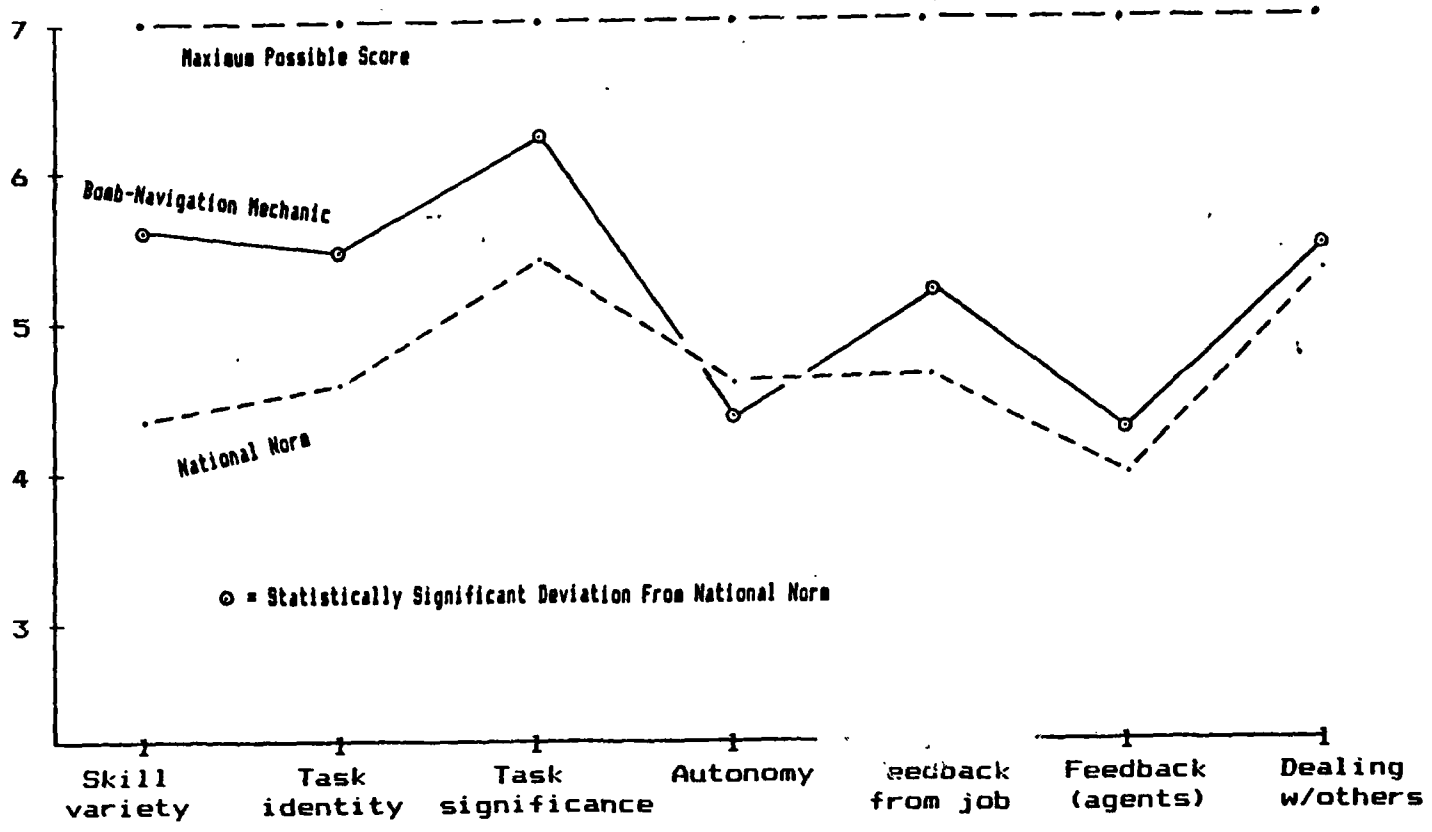


FIGURE 5

JOB DIAGNOSTIC PROFILE
BOMB-NAVIGATION SYSTEMS MECHANIC

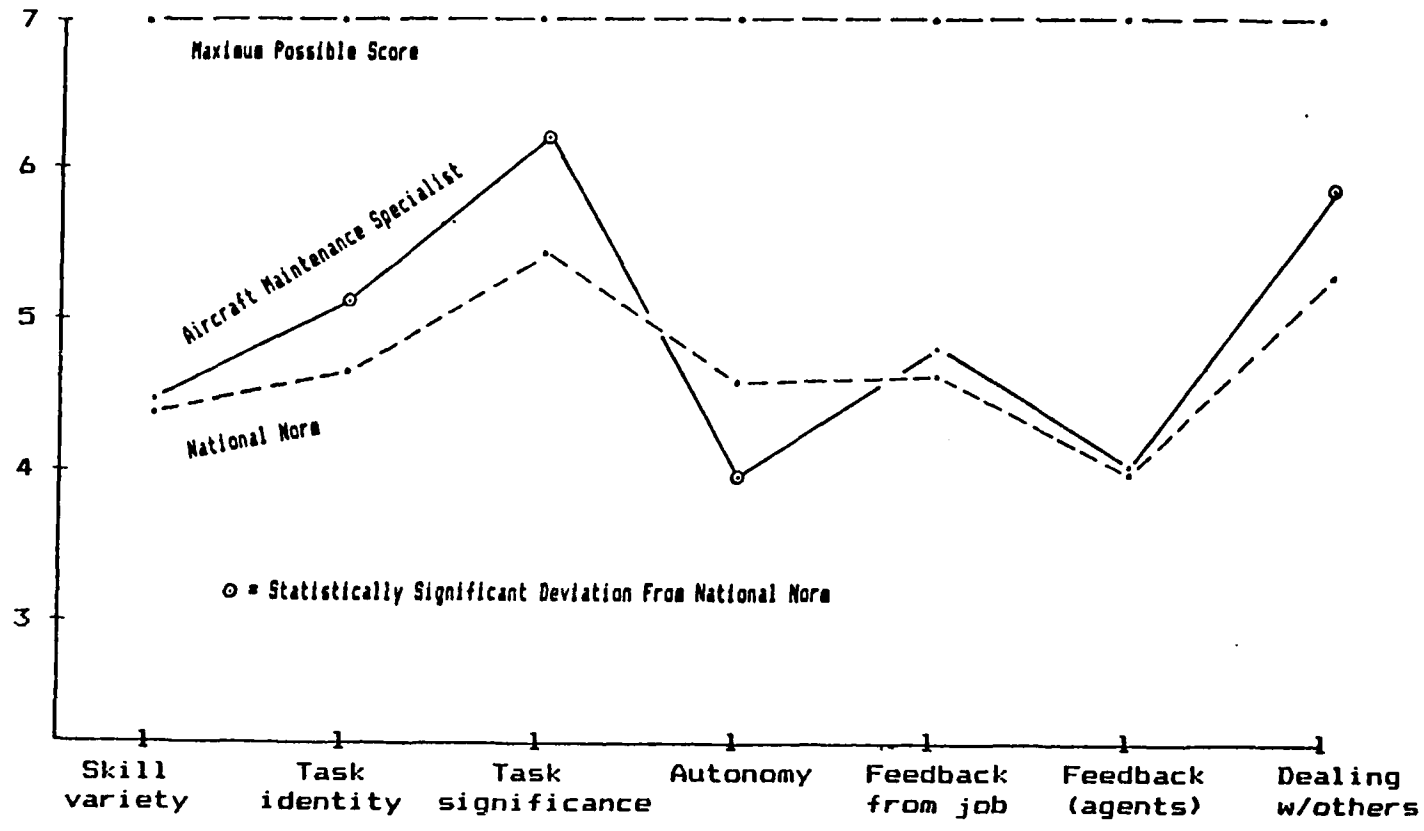


FIGURE 6

JOB DIAGNOSTIC PROFILE
AIRCRAFT MAINTENANCE SPECIALIST

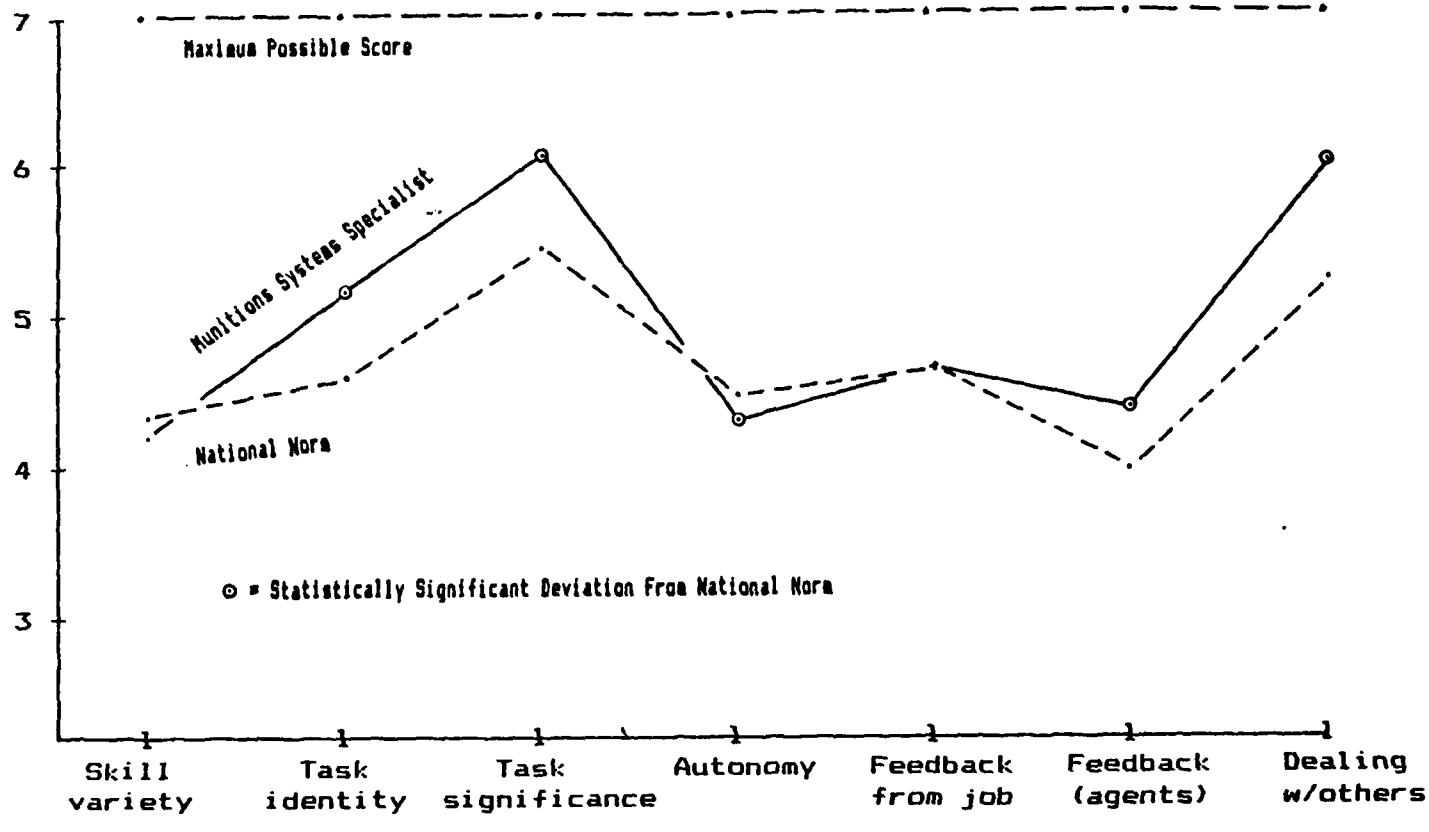


FIGURE 7

JOB DIAGNOSTIC PROFILE
MUNITIONS SYSTEMS SPECIALIST

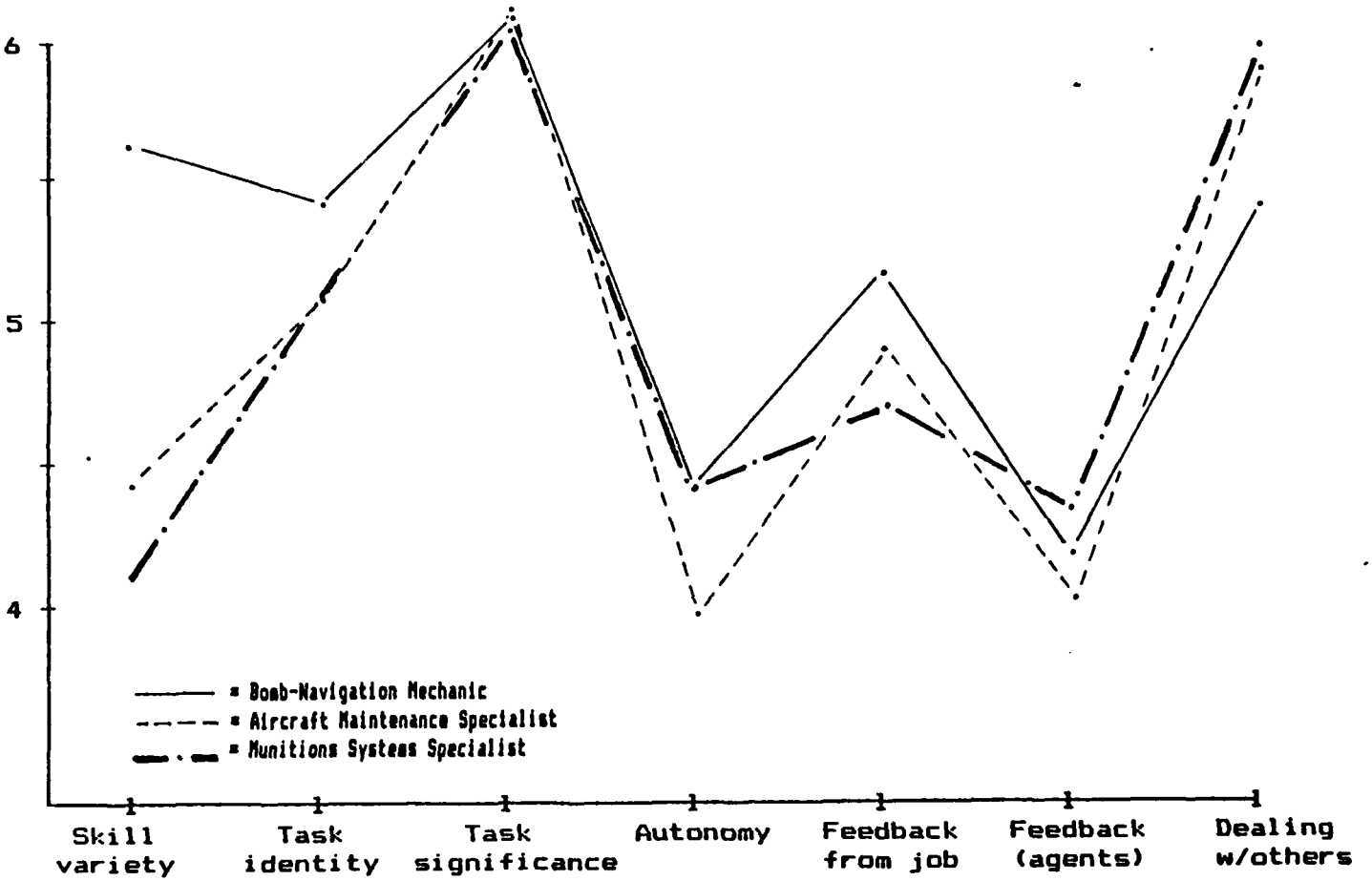


FIGURE 8

COMPARISON OF JOB PROFILES
FOR THREE CAREER FIELDS

lated with job satisfaction, internal work motivation, and growth satisfaction. The Pearson correlations for all the variables in each career field appear in Appendix E. A condensed table presenting the correlations between work outcomes and key job dimensions is presented in this section.

Correlations between work outcomes (job satisfaction, internal work motivation, and growth satisfaction) and key job dimensions for the maintenance population in aggregate are presented in Table 12. Job satisfaction was most strongly correlated with skill variety, the motivating potential score and security satisfaction. The two dimensions with the smallest degree of association with job satisfaction were dealing with others and pay satisfaction. Internal work motivation was most strongly correlated with feedback from the job itself, skill variety, and the composite motivating potential score. In contrast, the smallest degree of association with internal work motivation was task identity and pay satisfaction. Finally, growth satisfaction was most strongly correlated with the composite motivating potential score, social satisfaction, and skill variety, and was least correlated with dealing with others and growth need strength. In addition to the above correlations, the three work outcomes: job satisfaction, internal work motivation, and growth satisfactions were all highly correlated with each other. In other words, being

TABLE 12

CORRELATIONS BETWEEN WORK OUTCOMES
AND KEY JOB DIMENSIONS
(ALL MAINTENANCE PERSONNEL)

	Job Satisfaction	Internal Work Motivation	Growth Satisfaction
Skill Variety	.48	.40	.54
Task Identity	.24	.08	.29
Task Significance	.34	.37	.38
Autonomy	.31	.25	.51
Job Feedback	.40	.41	.50
Feedback (Agents)	.34	.21	.38
Dealing w/Others	.12	.15	.18
Pay Satisfaction	.16	.07	.23
Security Satisfaction	.41	.31	.43
Social Satisfaction	.33	.33	.59
Supervisory Satisfaction	.26	.26	.50
MPS	.47	.40	.64
Growth Need Strength	.21	.21	.13
Job Satisfaction	---	.50	.53
Internal Motivation	.50	---	.53
Growth Satisfaction	.53	.53	---

Note: For $|r| \geq .16$, $p \leq .001$.

satisfied with growth on the job usually led to general job satisfaction and internal work motivation.

Step 5: Analysis of the Work Context

In order to completely understand work outcomes, it is important to measure constructs not directly related to the design of work. These constructs measure worker satisfactions with such items as pay, security, social aspects, and supervisors. They are useful indicators of the degree to which job incumbents may be preoccupied with problems in the work environment, and therefore, psychologically unable to exploit the opportunities for growth and development in their jobs. This analysis was conducted in the identical format used for key job dimensions in the previous section. All of the statistical results are summarized in Table 13.

Pay satisfaction. Dissatisfaction with pay has been a dominant theme in articles examining military retention over the past several years. Based on this fact, the pay satisfaction of the career fields was not expected to differ, but all career fields were hypothesized to score below the national norm.

The results confirmed this hypothesis only for the bomb-navigation specialists. The degree of pay satisfaction for aircraft maintenance specialists and munitions systems specialists did not differ significantly from the national norm. Pay satisfaction of bomb-navigation mechanics was

also below the other two career fields, but not significantly.

TABLE 13

MEAN SCORES OF WORK CONTEXT SATISFACTIONS AND STATISTICAL COMPARISONS

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist	National Norm
Pay Satisfaction				
Mean	3.67	4.01	3.99	4.16
Std Dev	1.55	1.61	1.52	1.42
Z-value (Norm)	-3.18*	-.847	-1.13	
Z-value	-1.54	.091		
Z-value	-1.62			
Security Satisfaction				
Mean	5.19	5.11	5.09	4.71
Std Dev	1.12	1.29	1.27	1.21
Z-value (Norm)	4.12*	2.73*	2.98*	
Z-value	.469	.112		
Z-value	.651			
Social Satisfaction				
Mean	5.10	5.51	5.03	5.25
Std Dev	1.03	.833	1.04	.96
Z-value (Norm)	-1.44	2.64*	-2.13*	
Z-value	-3.19*	3.72*		
Z-value	.527			
Supervisory Satisfaction				
Mean	4.76	4.66	4.93	4.82
Std Dev	1.40	1.39	1.48	1.39
Z-value	-.402	-1.03	.717	
Z-value	-.514	-1.36		
Z-value	-.920			

* means value has one-tail significance level of .05

Security satisfaction. Job security is generally not a problem for military personnel who are adequately per-

forming their jobs. For this reason, all career fields were expected to score above the national norm.

The results totally supported this relationship. The three career fields scored significantly higher in security satisfaction than the national norm. In addition, the three career fields did not differ significantly in their levels of security satisfaction.

Social satisfaction. Social atmosphere in the military community is a key attraction to many of its members. Therefore, all three career fields were expected to score above the national norm.

The results do not confirm this hypothesis. Aircraft maintenance specialists scored significantly higher than the national norm and the other two career fields. Bomb-navigation mechanics did not significantly differ from the national norm. Aircraft maintenance specialists scored significantly higher than the national norm. Finally, munitions systems specialists scored significantly below the national norm.

Supervisory satisfaction. This is the final JDS measure of context satisfaction. Based on the comments generated by AFHRL open-ended surveys with maintenance personnel who expressed dissatisfaction with supervisory performance, the author hypothesized that all career fields would score below the national norm.

The results did not confirm this relationship. None

of the three career fields deviated significantly from the national norm. In addition, the career fields did not significantly differ from one another.

The sum total of results regarding work context satisfactions and key job dimensions must be analyzed before developing a strategy for redesigning focal jobs. The specific implications of these results will be highlighted in Chapter VI, Conclusions and Recommendations. One final question was examined as part of the data analysis phase. Are personnel assigned to the three career fields ready for change?

Step 6: Growth Need Strength

The final construct measured by the JDS is growth need strength. This measure is helpful in estimating whether people are likely to prosper in enriched jobs. The author proposed that all three career fields would respond above the national norm in growth need strength.

As depicted in Table 14, this hypothesis was supported for two career fields, but not for the third. The growth need strength of bomb-navigation system mechanics and aircraft maintenance specialists was significantly higher than the national norm. The growth need strength of munitions systems specialists did not differ significantly from the national norm. In addition, munitions specialists scored significantly lower than the other two career fields.

A summary of results obtained in steps five and six appears in Table 15.

TABLE 14

GROWTH NEED STRENGTH SCORE BY CAREER FIELD AND STATISTICAL COMPARISONS

Career Field	Mean Score/ Std. Dev.	Z-values 1	2	3
Bomb-Navigation Mechanic (121)	6.03/1.07	4.23*	1.26	3.03*
Aircraft Maintenance (89)	5.85/.990	2.39*	1.76*	
Munitions Specialist (122)	5.58/1.24	.065		
National Norm (500)	5.57/1.12			

* means value has one-tail significance level of .05

Summary

This completes the data analysis section of the research. This systematic approach to the collection of data and the analysis of that data has provided important insight into the attitudes of maintenance personnel about their jobs and the design of the work they perform. The final chapter will discuss the implications of these findings and recommend future research.

TABLE 15

RESULTS TABLE OF HYPOTHESES
TESTED IN STEPS 5 AND 6

(A) Career Fields Compared With National Norm

	Bomb-Nav Mechanic	Aircraft Maintenance	Munitions Specialist
Pay Satisfaction	Significantly Low	Not Significant	Not Significant
Security Satisfaction	Significantly High	Significantly High	Significantly High
Social Satisfaction	Not Significant	Significantly High	Significantly Low
Supervisory Satisfaction	Not Significant	Not Significant	Not Significant
Growth Need Strength	Significantly High	Significantly High	Not Significant

(B) Career Fields Compared With Each Other

1. Pay Satisfaction: No statistically significant differences between career fields.

2. Security Satisfaction: No statistically significant differences between career fields.

3. Social Satisfaction: Aircraft Maintenance Specialists were significantly higher than the other two career fields.

4. Supervisory Satisfaction: No statistically significant differences between career fields.

5. Growth Need Strength: Munitions Systems Specialists were significantly lower than the other two career fields.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

This final chapter represents a brief look at some of the issues raised by the data analysis. Its goal is not to design a job enrichment program for SAC aircraft maintenance. Instead, it is to draw conclusions regarding perceived strengths and weaknesses in the selected career fields and to recommend potential areas for improvement. First, the results of the data analysis chapter are discussed in terms of Hackman and Oldham's job characteristics model to reinforce the theoretical basis for this research. Next, the research objectives are accomplished by examining the perceived strengths and weaknesses of SAC aircraft maintenance in general, and the three career fields individually. Finally, recommended areas for future research are highlighted.

The Job Characteristics Model

The results of the data analysis support the relationships between core job dimensions and work outcomes specified in the job characteristics model. The work performed by bomb-navigation mechanics scored high in all but one core job dimension, autonomy, resulting in a motivating potential score significantly higher than the national norm and significantly higher than aircraft

maintenance specialists and munitions systems specialists. According to the model, bomb-navigation mechanics should exhibit positive work outcomes as a result of the enriched nature of their work. This prediction was supported as bomb-navigation mechanics scored significantly higher than the national norm in job satisfaction, internal work motivation, and growth satisfaction. In addition, bomb-navigation mechanics scored significantly higher than aircraft maintenance specialists and munitions systems specialists in internal work motivation and growth satisfaction. These relationships are depicted in Figure 9.

Implications for work design. If these results are consistent with the actual work environment in the three SAC aircraft maintenance career fields and the attitudes of its personnel, the findings contain important implications for Air Force managers. The most basic message involves the design of work. If managers desire to foster positive work outcomes as a means of achieving a potentially happier, and more productive work force, the key may lie in the design of work.

Often the design of work is not the outcome of a calculated effort to build positive qualities into jobs. Instead, it frequently results from other organizational demands relating to functional divisions or lines of authority. When decisions are made to structure jobs in a certain manner without considering the impact of task design or

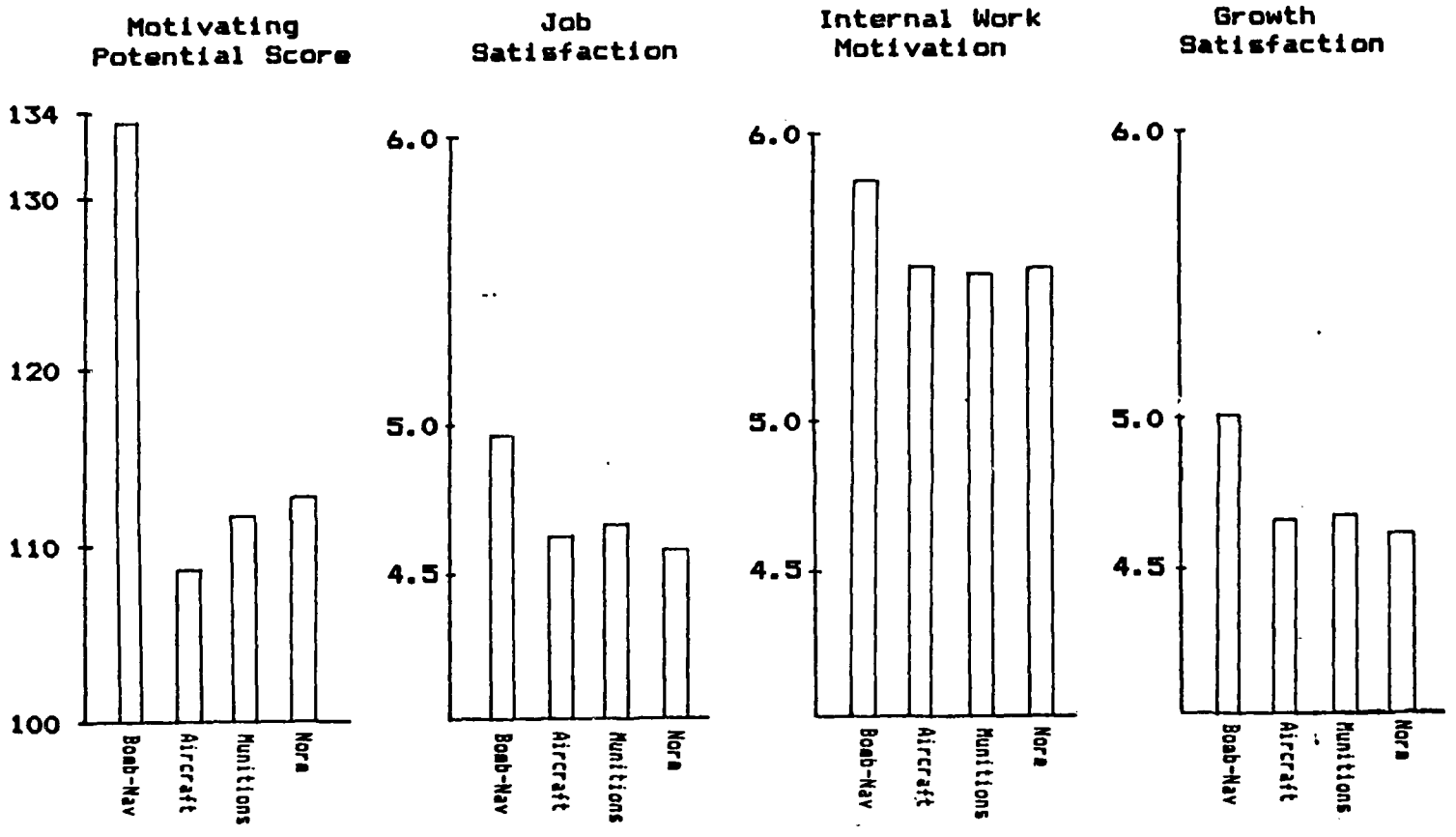


FIGURE 9

COMPARISON OF MOTIVATING POTENTIAL SCORE AND WORK OUTCOMES

employee attitudes, the consequences can be detrimental to the organization in the long run. However, positive outcomes can be achieved if jobs are designed with a systems perspective which considers the worker's attitudes about certain dimensions of the work. In fact, positive outcomes beyond those measured in this study may accrue to the organization. For example, when workers feel good about their work there may be a reduction in withdrawal behavior, such as lower absenteeism, and reduced turnover. In the Air Force environment where retention and the high cost of training technically qualified replacements are ever-present issues, work redesign may be a very effective strategy.

In summary, the data collected from the three career fields closely supports Hackman and Oldham's model. The career field exhibiting the characteristics of enriched work also had the highest self-reported levels of job satisfaction, internal work motivation, and growth satisfaction. Therefore, enriched work appears to yield very positive outcomes for both the worker and the organization. The clear indication to Air Force leaders is the necessity to consciously build positive dimensions into the tasks of all personnel.

SAC Aircraft Maintenance: Conclusions and Recommendations

The following section represents the author's interpretation of the data presented in Chapter V. Its

purpose is to fulfill the research objectives of this study by summarizing the perceived work outcomes, motivating potential, and strengths and weaknesses of each career field. In some cases, excerpts from the comments section of the returned surveys are used to highlight the findings presented.

The SAC maintenance community. This section summarizes observations with regard to SAC aircraft maintenance, in general, based on data accumulated from all three career fields.

The survey data and voluntary comments provided by the respondents indicate the presence of many positive job characteristics in SAC aircraft maintenance. These positive characteristics form a strong foundation for further improvement in the work environment. Both task identity and task significance scored consistently higher than the national norm across all three career fields. This implies SAC aircraft maintenance personnel perceive their tasks as involving a "whole" or identifiable piece of work and this work has substantial impact on the lives of other people. This perception results in the worker feeling worthwhile and important. In addition, security satisfaction was consistently high across all three career fields as well. Therefore, job security is probably not a work context issue that will detract from efforts to improve the SAC aircraft maintenance environment.

Three areas generally receiving poor ratings were autonomy, pay satisfaction, and supervisory satisfaction. Autonomy is a very difficult issue to deal with in the military. The common remedy for low levels of autonomy suggests job holders be given more discretion in setting schedules, determining work methods, and deciding when and how to check on the quality of work produced. Several elements of the Air Force maintenance environment yield these solutions difficult to use, if not impractical. Shortages of both maintenance personnel and critical equipment, and the requirement for close coordination between maintenance squadrons, often necessitates central scheduling. In addition, past attrition or turnover of technicians may have lowered experience levels. This factor makes it impractical to let maintenance personnel perform their own quality control. Improving autonomy becomes particularly difficult under these conditions. Despite these barriers, unit managers should constantly assess the work environment and build into it as much autonomy as practical, in order for maintenance personnel to experience personal responsibility for the work they perform.

Low pay satisfaction is the second problem area identified by the study. This finding is not new or surprising, and unfortunately, there is little first-line supervisors can do to alter Department of Defense pay policies. However, the DOD must continue to monitor pay

issues and assess their impact on the morale of military personnel. With the recent upturn in the U.S. economy and reduction in unemployment rates, military pay levels may become even more critical in the retention of experienced technicians in critical career fields such as, aircraft maintenance.

The third weakness identified by the survey responses was supervisory satisfaction. It was low in all three career fields, but was rated particularly low in aircraft maintenance. It is hard to discuss supervisory satisfaction without also discussing feedback from agents. Correlation analysis showed a strong positive correlation between these measurements. In addition, many of the comments from the respondents included both a reference to supervision and feedback. To underscore the complexity of this interrelationship, a sampling of comments representing responses from all three career fields appears below.

> Bomb-Navigation Mechanic, E-4: Supervision is the biggest factor. When a job is done well by any airman, the supervisor (or higher) takes credit and the airman receives nothing for his own good job. Well, I can only say this leads to very bad attitudes. Bad attitudes are the worst problem in our shop.

> Bomb-Navigation Mechanic, E-4: The supervisors in my career field seem less and less interested in the morale and welfare of their subordinates, but are constantly increasing their insistence on time usage and getting the job done immediately. Further, supervisors tend to criticize much more than they praise, and sometimes give no feedback on the adequacy of performance, unless it is

> negative, until asked. Many supervisors also rob the worker of initiative by specifying exactly how the job is to be done, right down to the small details.
>
> Munitions Systems Specialist, E-4: My men and myself have put in over 60 hours a week since the end of December, not including ORIs [operational readiness inspections], with no thanks from anyone. My toughest job is to keep up morale, theirs and mine.
>
> Aircraft Maintenance Specialist, E-3: I would like to stay in because the job is very interesting, but the supers will not give us any breaks. They play favorites.

The issue of supervision is discussed here because of the key role it can play in creating a work environment conducive to positive work outcomes. Air Force managers have a great deal of control over supervisory style at the unit level, whereas some of the other job dimensions must be addressed at the command level. Recognizing this, Air Force leaders should stress the benefits of good supervision to their middle managers and encourage the use of timely feedback. When good supervision is present, personnel recognize and respond to it. According to one E-5, Bomb-Navigation Mechanic,

> Bomb-Navigation Mechanic, E-5: I find my job interesting, challenging, and self-satisfying. In most cases I get along with the people I work for and any disputes that do crop up are worked out. I was lucky in having some excellent supervisors that took the time to listen to any problems and care about the people they supervise.

This comment reinforces the notion that there are already excellent supervisors in the Air Force and workers appreciate the benefits of good supervision. The key role the supervisor plays in any organization cannot be overemphasized.

Bomb-navigation systems mechanics. The data compiled and analyzed on bomb-navigation mechanics presents a very positive picture of this career field. The scores for key job dimensions and work outcomes were consistently higher than both the national norms and the other two career fields evaluated in this study. Many of the comments from bomb-navigation mechanics supported these findings. An E-5 wrote, "The work I do provides me with a challenge to learn and helps me as far as a good career." Similarly, an E-3 commented, "The job I perform isn't limited to a specific function. There are many areas of work involved in my job which offer a lot to learn." The reason for the perceived enriched nature of the work in this career field may have a lot to do with the types of duties performed, which are naturally high in several of the key job dimensions discussed in the job characteristics model.

Despite this very positive appraisal, there are a few negative areas which deserve attention. First, bomb-navigation mechanics rated pay satisfaction significantly lower than the national norm and considerably lower than the other two career fields, although these differences were not

statistically significant. Two explanations may account for this result. First, several of the survey comments expressed concern over the continuance of the selective reenlistment bonus (SRB). (The SRB is a reenlistment bonus applicable to specified critical career fields.) Several respondents indicated their decision to remain in the Air Force depended on the future of SRBs in the bomb-navigation career field. A second explanation may reflect the desire of bomb-navigation mechanics to be compensated for performing work they perceive as enriched. They may view their work as deserving of pay above that received by other career fields due to the comparative complexity and mental demands of the work.

A second potential problem area in the bomb-navigation career field is the level of autonomy, which was below the national norm, but above the aircraft maintenance career field. The dimension of autonomy has already been presented in detail and is omitted from further discussion.

In summary, there were many positive job dimensions found in the work of bomb-navigation mechanics. The data present a picture of a perceived enriched environment, occupied by motivated workers who are generally satisfied with their jobs and their personal growth at work. Air Force managers should seek to maintain and improve upon this atmosphere whenever possible.

Aircraft maintenance specialists. In contrast to

the bomb-navigation career field, the data collected supports the need for more wide-ranging improvements in this career field. The positive aspects in the aircraft maintenance career field are task identity, task significance, and social satisfaction. The fact aircraft maintenance specialists view their work as significant and identify strongly with how their work fits into the overall mission, establishes a good environment for changes aimed at improving the work design. In addition, there does not appear to be perceived problems in work context satisfactions, with the exception of supervisory satisfaction. In fact, aircraft maintenance specialists achieved a significantly higher score in social satisfaction than both the national norm and the other two career fields.

Some of these positive aspects are neutralized by weaknesses in the career field. For example, the level of autonomy score in aircraft maintenance was significantly below the national norm and the other two career fields. Given the author's perceptions of flight-line work, it does not seem consistent for autonomy in aircraft maintenance to be significantly lower than the munitions career field. The comments below from two aircraft maintenance specialists help highlight the nature of this problem.

> (E-5): I would like more freedom in deciding how and when to do the job and less interference from supervisors and quality control. I feel that in general the top level supervision in my career field is mired down worrying about trivial items.

> The only time I am comfortable about my job is while TDY [temporary duty away from permanent base of assignment] on a base in a different command where I work directly for the pilot of the aircraft. He tells me his crew show time [the time crew will arrive at aircraft for preflight] and fuel load and I make all other decisions concerning my schedule and any maintenance actions to be performed on the aircraft.
>
> (E-4): No challenge. After being out [of the military] for 6 years and coming back in they have taken most of the responsibilities away that were there before.

This finding may not represent anything new to SAC leadership. However, it does reinforce the relevance of autonomy as a key issue in this career field. As stated earlier, low levels of autonomy may largely be attributed to the experience levels of aircraft maintenance specialists, the shortages of qualified personnel and equipment, and the complexity of modern weapon systems. However, the level of autonomy in aircraft maintenance may have been permitted to drop too low and negative work outcomes are beginning to show up in the work environment. Therefore, increasing the sense of responsibility through increased autonomy in the aircraft maintenance career field should be a prime goal for the future.

Two additional issues in aircraft maintenance relate to feedback from agents and supervisory satisfaction. Feedback from agents and supervisory satisfaction were rated lower by aircraft maintenance specialists than the other two career fields. The correlation analysis supported a strong

positive relationship between these variables. Although these measures were not significantly low, when combined with some of the comments there is strong evidence of weakness in this area. There are many possible explanations for this low rating. For example, the open, dynamic flight-line environment makes supervision more difficult than in a closed, controlled shop environment. Supervisors are in short supply and have great difficulty covering the flight-line and giving timely feedback. Another possible explanation relates to how supervisors are selected. As technicians move up in skill level they are expected to assume more supervisory functions. Obviously, good technicians do not necessarily make good supervisors. Without proper training these technicians turned supervisor may not be aware of the important role they play in the organization. Of course, this is an issue for all of the career fields and does not explain the low rating in the aircraft maintenance career field.

One final aspect deserving mention is the growth need strength (GNS) of aircraft maintenance personnel. They scored significantly higher than the national norm in GNS. This indicates a desire for enriched work and is an important prerequisite to successful job redesign. Thus, both the need for enriched work and the desire for such work is present. The payoffs of job redesign for this career field may be very worthwhile to the Air Force and the individual.

Munitions systems specialist. The last career field showed mixed results in terms of the survey responses. Task identity and task significance were significantly higher than the national norm. Feedback from agents, dealing with others, and supervisory satisfaction were all strong points. This may relate to how the work is organized among the specialists. Autonomy scored significantly below the national norm, but in actuality may represent a positive aspect of the work. The level of autonomy did not differ significantly from bomb-navigation mechanics, but was significantly higher than aircraft maintenance specialists. It appears that despite the sensitive nature of the tasks performed, the structure of the work environment in this career field leads to a perception of increased autonomy.

The apparent weaknesses are skill variety, feedback from the job itself, and social satisfaction. The following comment from an E-3 indicates the nature of the problem captured in the low skill variety score.

> My job has very little job satisfaction. I do the same thing day after day. If I can't cross-train into a more job satisfying career field I will most definitely get out [of the Air Force].

This issue is probably not a new one to the munitions career field. The nature of the work may not foster the use of a variety of skills. This research simply supports the existence of the skill variety problem and encourages

supervisors to continually find ways to improve this dimension of munitions work.

Feedback from the job itself is an issue in the munitions career field in need of improvement. It is often hard to separate feedback from agents and feedback from the job. However, based on the data, feedback from agents appears to be a positive dimension in this career field, while feedback from the job is a weakness. According to Hackman and Oldham (16:65), one way of dealing with feedback problems is to open feedback communication channels to help individuals learn whether their performance is improving, deteriorating, or remaining at a constant level. One important feedback channel is the client of the organization's services, or in this case, the aircrew. A comment from an E-4 supports the notion that part of the problem relates to client feedback:

> We had a bomb drop test on 11 Mar 83, and myself and my crew assembled those bombs. Well the aircraft returned the next day without the bombs and I have not heard anything about how well the bomb drop went.

Two other issues deserve mention. First, social satisfaction was rated significantly lower than the national norm and significantly lower the other two career fields. This poor rating is difficult to explain given the high marks in other areas and warrants further investigation. To accomplish this investigation, data in this report should be

cross-referenced with other sources (1981 AFHRL study and interviews with experienced munitions personnel) to isolate the nature of this poor rating in social satisfaction. The second issue concerns the growth need strength of munitions systems specialists. Whereas the other two career fields exhibited a preference for enriched work, munitions specialists did not deviate from the national norm. In addition, they scored significantly lower than the other two career fields. Perhaps the most viable conclusion is that a plan for job redesign should be approached cautiously for this career field and deliberate changes should be made and assessed incrementally.

Summary. The data analysis provided important insight for all levels of SAC leadership on both the strengths and weaknesses of three vital career fields in aircraft maintenance. First, there appears to be a solid foundation upon which to build in further improvements in the design of work for all three career fields. Evidence of this solid base is the across the board high scores achieved in task identity and task significance. It is up to SAC managers to capitalize on these positive dimensions while seeking to improve on weaker dimensions of the work.

Several weaknesses have been detailed for each career field and for SAC aircraft maintenance, in general. It is the author's opinion that well-planned improvements in supervisory performance, and feedback from both the job and

agents represent the greatest potential payoffs for SAC maintenance organizations. Whereas some of the problems previously identified probably require command level intervention and potentially large reorganization, the issue of supervision and feedback are well within control of unit level managers at very little cost. Although supervision and feedback from agents are not key job dimensions, they may very well influence worker's perceptions of these dimensions and ultimately influence work outcomes both directly and indirectly.

Recommendations for Future Research

There are many potential avenues for future research in this area, some specifically aimed at SAC aircraft maintenance and others more broad in scope. Some of the key topics for future research are discussed below.

(1) The data compiled in this study should be cross-referenced with other data to validate the findings. The qualitative data gathered by AFHRL (4) is one good initial source of data for such an effort. If the two sources indicate the same problem areas, one could suggest a strong case for job redesign.

(2) The findings of this study should be presented to a cross-section of aircraft maintenance personnel, representing all levels, to solicit comments on the findings and specific recommendations for improving the nature of the

work. These comments may indicate the need for small, unit level changes in the way certain tasks are performed as a means of improving affective reactions to the work. However, the changes may be much larger in scope and therefore require command level approval, coordination, and support. In any case, the need to explore some of the possible weaknesses in more detail is evident.

(3) The data can also be used as a baseline for assessing the impact of changes adopted in the specific career fields. For example, if a structured effort to increase skill variety is implemented in munitions, the data in this report can be compared with similar data collected after the change has occurred. This comparison will give Air Force management one method of judging the success of their initiatives.

(4) The data in this report also serves as the beginning of normative data for use in diagnosing military organizations. One of the problems encountered in this study was an apparent lack of suitable data to serve as a baseline for comparison purposes. Future research aimed at compiling and categorizing military norms for the JDS in a manner similar to Hackman, Oldham, and Stepina (18) could be very worthwhile. If unit managers had easy access to such a data base, they could conduct effective diagnosis to systematically review the nature of work in their organizations.

(5) One final avenue of research involves comparing the JDS responses of personnel in centralized maintenance organizations, such as SAC and MAC, with personnel in aircraft maintenance units organized under the COMO concept. One purpose of COMO (originally called POMO) was to reduce dissatisfaction amongst aircraft maintenance technicians. Therefore, it would be very interesting to compare the reactions of personnel from similar career fields to their work and to compare their work outcomes. Centralized maintenance organizations may be able to learn a great deal if COMO units actually exhibit significantly higher work outcomes.

Summary

This chapter has brought the research project to a logical conclusion. First, the results were related to the model on which the survey instrument was based. Then, a practical application of the model was achieved by systematically diagnosing three SAC aircraft maintenance career fields and presenting the findings. Specific strengths and weaknesses were cited in hopes of influencing unit and command policies that affect work design in the future. Finally, avenues for future research were detailed in hopes of increasing the ability of managers to build positive qualities into jobs and to learn more about the effects of work design on their employees.

APPENDIX A

RESEARCH QUESTIONS/HYPOTHESES IN EXPANDED FORMAT

Based on Air Force Human Resources Laboratory (AFHRL) qualitative data, Air Force Regulation 39-1 job descriptions, and the job characteristics model the following research questions/hypotheses apply:

1. As measured by the Job Diagnostic Survey (JDS), what is the perceived level of job satisfaction in the selected maintenance career fields?

   a. The mean level of job satisfaction of bomb-navigation systems mechanics is significantly higher than the national norm.

   b. The mean level of job satisfaction of aircraft maintenance specialists is significantly lower than the national norm.

   c. The mean level of job satisfaction of munitions systems specialists is significantly lower than the national norm.

2. As measured by the JDS, what is the perceived level of internal work motivation in the selected maintenance career fields?

   a. The mean level of internal work motivation of bomb-navigation systems mechanics is significantly higher than the national norm.

   b. The mean level of internal work motivation of aircraft maintenance specialists is significantly lower than the national norm.

   c. The mean level of internal work motivation of munitions systems specialists is significantly lower than the national norm.

3. As measured by the JDS, what is the perceived level of growth satisfaction in the selected maintenance career fields?

a. The mean level of growth satisfaction of bomb-navigation systems mechanics is significantly higher than the national norm.

b. The mean level of growth satisfaction of aircraft maintenance specialists is significantly lower than the national norm.

c. The mean level of growth satisfaction of munitions systems specialists is significantly lower than the national norm.

4. As measured by the JDS, are any of the selected maintenance career fields rated low in motivating potential?

a. The mean composite motivating potential score of bomb-navigation systems mechanics is significantly higher than the national norm.

b. The mean composite motivating potential score of aircraft maintenance specialists is significantly lower than the national norm.

c. The mean composite motivating potential score of munitions systems specialists is significantly lower than the national norm.

5. As measured by the JDS, what specific aspects of the job are contributing to low job satisfaction, low internal motivation, or low growth satisfaction?

a. The degree to which a job requires the worker to perform activities which challenge his skills and abilities (skill variety) is significantly higher for bomb-navigation systems mechanics and significantly lower for munitions systems specialists and aircraft maintenance specialists than the national norm.

b. The degree to which a job requires the worker to perform a "whole" and identifiable piece of work (task identity) is significantly higher for bomb-navigation systems mechanics and significantly lower for munitions systems specialists and aircraft maintenance specialists than the national norm.

c. The degree to which the job has a substantial and perceived impact on the lives of other people (task significance) is significantly higher for all three career fields than the national norm.

d. The degree to which the job gives the worker freedom, independence, and discretion in scheduling work and determining how it will be performed (autonomy) is significantly higher for bomb-navigation systems mechanics and significantly lower for munitions systems specialists and aircraft maintenance specialists than the national norm.

e. The degree to which the worker, in carrying out work activities required by the job, receives information about the effectiveness of his efforts (feedback from the job) is significantly higher for aircraft maintenance specialists and bomb-navigation systems mechanics and significantly lower for munitions systems specialists than the national norm.

f. The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers (feedback from agents) is significantly higher for all three career fields than the national norm.

g. The degree to which the job requires employees to work closely with other people in carrying out the work activities (dealing with others) is significantly higher for all three career fields than the national norm.

6. As measured by the JDS, are personnel in the selected career fields satisfied with elements of the work environment?

a. Pay satisfaction is significantly lower in all three career fields than the national norm.

b. Security satisfaction is significantly higher in all three career fields than the national norm.

c. Social satisfaction is significantly higher in all three career fields than the national norm.

d. Supervisory satisfaction is significantly higher in all three career fields than the national norm.

7. As measured by the JDS, are maintenance personnel ready for change in the design of work as measured by their growth need strength (GNS)?

The growth need strength of personnel assigned to all three career fields is significantly higher than the national norm.

APPENDIX B

TASK CHARACTERISTICS AND JOB ATTITUDE QUESTIONNAIRE (14:62-69)

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (ATC)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

REPLY TO ATTN OF LSH (LSSR 17-83)/Capt C. Flynn/AUTOVON 785-4437

SUBJECT Task Characteristics and Job Attitude Questionnaire

TO

1. The attached questionnaire is designed to assist in the study of your job and to show how it affects you. The survey data will help to determine how jobs can be better designed by obtaining information about how people react to different kinds of jobs.

2. On the following pages, you will find several different kinds of questions about your job. Specific instructions are given at the start of each section. You are requested to provide an answer or comment for each question. Please read them carefully. It should take about fifteen minutes to complete the entire questionnaire. Headquarters USAF Survey Control Number 83-13 has been assigned to this questionnaire. Your participation in this research is voluntary.

3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated. Please return the completed questionnaire in the attached envelope within one week after receipt.

JEROME G. PEPPERS, JR.
Associate Dean
School of Systems and Logistics

2 Atch
1. Questionnaire
2. Return Envelope

PRIVACY STATEMENT

In accordance with paragraph 8, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

(1) 5 U.S.C.301, Departmental Regulations, and/or

(2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and/or

(3) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and/or

(4) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine Uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in written master's theses and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

SECTION ONE

This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1----------2----------3----------4----------5----------(6)----------7

Very little; the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much; the job requires almost constant work with mechanical equipment.

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time--but also requires some paperwork--you might circle the number six, as was done in the example above.

Please turn the page and begin.

1. To what extent does your job require you to work closely with other people (either clients, or people in related jobs in your own organization)?

1----------2---------3---------4---------5---------6---------7

Very little; dealing with other people is not at all necessary in doing the job.	Moderately; some dealing with others is necessary.	Very much; dealing with other people is an absolutely essential and crucial part of doing the job.

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1----------2---------3---------4---------5---------6---------7

Very little; the job gives me almost no personal "say" about how and when the work is done.	Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work.	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1----------2---------3---------4---------5---------6---------7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1----------2---------3---------4---------5---------6---------7

Very little; the job requires me to do the same routine things over and over again.	Moderate variety	Very much; the job requires me to do many different things, using a number of different skills and talents.

5. In general, how <u>significant or important</u> is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1----------2---------3---------4---------5---------6---------7

Not very significant; the outcomes of my work are <u>not</u> likely to have important effects on other people.	Moderately significant.	Highly significant; the outcomes of my work can affect other people in very important ways.

6. To what extent do <u>managers or co-workers</u> let you know how well you are doing on your job?

1----------2---------3---------4---------5---------6---------7

Very little; people almost never let me know how well I am doing.	Moderately; sometimes people may give me "feedback;" other times they may not.	Very much; managers or co-workers provide me with almost constant "feedback" about how well I am doing.

7. To what extent does <u>doing the job itself</u> provide you with information about your work performance? That is, does the actual <u>work itself</u> provide clues about how well you are doing--aside from any "feedback" co-workers or supervisors may provide?

1----------2---------3---------4---------5---------6---------7

Very little; the job itself is set up so I could work forever without finding out how well I am doing.	Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.	Very much; the job is set up so that I get almost constant "feedback" as I work about how well I am doing.

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job--regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Slightly Inaccurate	Uncertain	Slightly Accurate	Mostly Accurate	Very Accurate

____1. The job requires me to use a number of complex or high-level skills.

____2. The job requires a lot of cooperative work with other people.

____3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.

____4. Just doing the work required by the job provides many chances for me to figure out how well I am doing.

____5. The job is quite simple and repetitive.

____6. The job can be done adequately by a person working alone--without talking or checking with other people.

____7. The supervisors and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.

____8. This job is one where a lot of other people can be affected by how well the work gets done.

____9. The job denies me any chance to use my personal initiative or judgment in carrying out the work.

___10. Supervisors often let me know how well they think I am performing the job.

___11. The job provides me the chance to completely finish the pieces of work I begin.

___12. The job itself provides very few clues about whether or not I am performing well.

___13. The job gives me considerable opportunity for independence and freedom in how I do the work.

___14. The job itself is not very significant or important in the broader scheme of things.

SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Slightly	Neutral	Agree Slightly	Agree	Agree Strongly

____1. My opinion of myself goes up when I do this job well.

____2. Generally speaking, I am very satisfied with this job.

____3. I feel a great sense of personal satisfaction when I do this job well.

____4. I frequently think of quitting this job.

____5. I feel bad and unhappy when I discover that I have performed poorly on this job.

____6. I am generally satisfied with the kind of work I do in this job.

____7. My own feelings generally are not affected much one way or the other by how well I do on this job.

SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

1	2	3	4	5	6	7
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extremely Satisfied

____1. The amount of job security I have.

____2. The amount of pay and fringe benefits I receive.

____3. The amount of personal growth and development I get in doing my job.

____4. The people I talk to and work with on my job.

____5. The degree of respect and fair treatment I receive from my boss.

____6. The feeling of worthwhile accomplishment I get from doing my job.

____7. The chance to get to know other people while on the job.

____8. The amount of support and guidance I receive from my supervisor.

____9. The degree to which I am fairly paid for what I contribute to this organization.

___10. The amount of independent thought and action I can exercise in my job.

___11. How secure things look for me in the future in this organization.

___12. The chance to help other people while at work.

___13. The amount of challenge in my job.

___14. The overall quality of the supervision I receive in my work.

SECTION FIVE

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

4	5	6	7	8	9	10
Would like having this only a moderate amount (or less)			Would like having this very much			Would like having this extremely much

____1. High respect and fair treatment from my supervisor.

____2. Stimulating and challenging work.

____3. Chances to exercise independent thought and action in my job.

____4. Great job security.

____5. Very friendly co-workers.

____6. Opportunities to learn new things from my work.

____7. High salary and good fringe benefits.

____8. Opportunities to be creative and imaginative in my work.

____9. Quick promotions.

___10. Opportunities for personal growth and development in my job.

___11. A sense of worthwhile accomplishment in my work.

SECTION SIX
BIOGRAPHICAL DATA

All information in this section will be held in the strictest confidence; no one in your organization will have access to individual responses.

1. What is your present active duty grade? (Check one)

_____A.	E-1	_____F.	E-6
_____B.	E-2	_____G.	E-7
_____C.	E-3	_____H.	E-8
_____D.	E-4	_____I.	E-9
_____E.	E-5		

2. How much total active federal military service have you completed? (Check one)

_____A. Less than one year
_____B. 1 - 4 years
_____C. 5 - 8 years
_____D. 9 - 12 years
_____E. 13 - 16 years
_____F. Over 16 years

3. What is your age? (Check one)

_____A. Under 20 years
_____B. 21 - 25 years
_____C. 26 - 30 years
_____D. 31 - 35 years
_____E. 36 - 40 years
_____F. 41 - 45 years
_____G. Over 45 years

4. What is your highest education level? (Check one)

_____A. Grade School
_____B. Some High School
_____C. High School Graduate
_____D. Some College
_____E. College Graduate
_____F. Some Graduate Work
_____G. Graduate Degree

5. What is your sex?

_____Male _____Female

6. What is your marital status?

_____Married _____Not Married

7. What is your organizational identifier? (Check one)

_____A. AMS
_____B. FMS
_____C. MMS
_____D. OMS
_____E. Other (please specify _____)

8. What is your current specialty code (AFSC)? (Check one)

_____A. AFSC 321X0
_____B. AFSC 431X2
_____C. AFSC 461X0
_____D. Other (please specify _____)

9. What is your skill level in your current job specialty?

_____A. 3 Level
_____B. 5 Level
_____C. 7 Level
_____D. 9 Level

10. Have you worked in your present career field throughout your Air Force career?

_____ Yes _____ No

If no, how long have you worked in your present career field?

_____A. Less than one year
_____B. 1 - 4 years
_____C. 5 - 8 years
_____D. 9 - 12 years
_____E. Over 12 years

11. Do you supervise others?

_____ Yes _____ No

If yes, how many personnel do you supervise? (Check one)

_____A. Less than 5 personnel
_____B. 6 - 10 personnel
_____C. 11 - 15 personnel
_____D. 16 - 20 personnel
_____E. 21 - 30 personnel
_____F. Over 30 personnel

12. Do you intend to stay in the Air Force beyond your present commitment? (Check one)

_____A. No, I am separating.
_____B. No, I am retiring.
_____C. Undecided
_____D. Yes

If the answer to this question is NO or UNDECIDED, please answer the following question.

13. Is your present job a major factor in your decision?

_____ No _____ Yes

If YES, in what way? Your comments will be most helpful in making any recommendations for change deemed necessary by this study.

APPENDIX C

SCORING KEY FOR THE SHORT FORM OF THE JOB DIAGNOSTIC SURVEY (17:303-306)

The Short Form of the Job Diagnostic Survey (JDS) measures several characteristics of jobs, the reactions of the respondents to their jobs, and the growth need strength of the respondents. Some of the scales tapped by the JDS are not included in the Short Form; others are measured with fewer items. The scales measuring the objective job dimensions are; however, identical with those in the JDS.

Each variable measured by the JDS Short Form is listed below, along with (a) a one or two sentence description of the variable, and (b) a list of the questionnaire items which are averaged to yield a summary score for the variable.

* * * * * * * * *

I. JOB DIMENSIONS: Objective characteristics of the job itself.

A. Skill Variety: The degree to which a job requires a variety of different activities in carrying out the work, which involves the use of a number of different skills and talents of the employee.

Average the following items:

Section One #4
Section Two #1
#5 (reversed scoring--i.e., subtract number entered by respondent from 8)

B. Task Identity: The degree to which the job requires the completion of a "whole" and identifiable piece of work--i.e., doing a job from beginning to end with a visible outcome.

Average the following items:

Section One #3
Section Two #11
#3 (reversed scoring)

C. Task Significance: The degree to which the job has a substantial impact on the lives or work of other people -whether in the immediate organization or in the external environment.

Average the following items:

Section One #5
Section Two #8
#14 (reversed scoring)

D. Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling his work and in determining the procedures to be used in carrying it out.

Average the following items:

Section One #2
Section Two #13
#9 (reversed scoring)

E. Feedback From the Job Itself: The degree to which carrying out the work activities required by the job results in the employee obtaining information about the effectiveness of his or her performance.

Average the following items:

Section One #7
Section Two #4
#12 (reversed scoring)

F. Feedback From Agents: The degree to which the employee receives information about his or her performance effectiveness from supervisors or from co-workers. (This construct is not a job characteristic per se, and is included only to provide information supplementary to construct (E) above.)

Average the following items:

Section One #6
Section Two #10
#7 (reversed scoring)

G. Dealing With Others: The degree to which the job requires the employee to work closely with other people (whether other organization members or organizational "clients").

Average the following items:

Section One #1
Section Two #2
#6 (reversed scoring)

II. AFFECTIVE RESPONSES TO THE JOB: The private, affective reactions or feelings an employee gets from working on his job.

A. General Satisfaction: An overall measure of the degree to which the employee is satisfied and happy in his or her work.

Average the following items:

Section Three #2
#6
#4 (reversed scoring)

B. Internal Work Motivation: The degree to which the employee is self-motivated to perform effectively on the job.

Average the following items:

Section Three #1
#3
#5
#7 (reversed scoring)

C. Specific Satisfactions: These short scales tap several specific aspects of the employee's job satisfaction.

C1. Pay satisfaction. Average items #2 and #9 of Section Four.
C2. Security satisfaction. Average items #1 and #11 of Section Four.
C3. Social satisfaction. Average items #4, #7, and #12 of Section Four.
C4. Supervisory satisfaction. Average items #5, #8, and #14 of Section Four.
C5. Growth satisfaction. Average items #3, #6, #10, and #13 of Section Four.

III. INDIVIDUAL GROWTH NEED STRENGTH: This scale taps the degree to which an employee has strong versus weak desire to obtain "growth" satisfactions from his or her work.

Average the six items from Section Five listed below. Before averaging, subtract 3 from each item score; this will result in a summary scale ranging from one to seven. The items are: #2, #3, #6, #8, #10, and #11.

IV. MOTIVATING POTENTIAL SCORE: The score reflecting the potential of a job for eliciting positive internal work motivation on the part of employees (especially those with high desire for growth need satisfaction) is given below.

$$MPS = \left[\frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3}\right] \times \text{Autonomy} \times \text{Feedback From the Job}$$

APPENDIX D

JOB DIAGNOSTIC SURVEY
EMPIRICAL PROPERTIES
(14:71-73)

Various forms of the JDS have been administered by Hackman and Oldham to over 6900 individuals holding more than 870 different types of jobs in 56 organizations. The sample population characteristics were highly heterogeneous, including professional, sales, clerical, and managerial workers. Industrial, service and governmental organizations were included in the sample. The organizations were located in all geographic sections of the United States. Results obtained from each study group have validated the reliabilities of the JDS scales which were originally based on data obtained from 658 workers engaged in 62 different jobs in seven organizations. Although the JDS has undergone three major revisions, the reliabilities of component scales remain highly satisfactory (14:14-15).

Internal consistency reliabilities for each of the JDS scales are shown in Table 16. The reliabilities range from a high of .88 to a low of .58. In general, the results were similar to those reported in earlier studies but tend to be somewhat lower than reliabilities previously obtained. The results also support the point made by Hackman and Oldham (17:314-315) that the JDS is not appropriate for diagnosing the jobs of single individuals. Instead, the JDS is recommended for diagnostic purposes only when several individuals work in a given job. When used for this

purpose, the JDS job dimension scale reliabilities are more than adequate (18:9).

Another empirical test was an assessment of the objectivity of job dimensions. The job dimensions for each focal job were rated by employees who worked in the job, by supervisors, and by outside observers (researchers). The purpose was to obtain an indirect test of the objectivity of employee ratings of the characteristics of their own jobs. In general, ratings of the three groups converged moderately well. However, for a few job dimensions, correlations between two of the groups were quite low. In response to this anomaly, Hackman and Oldham argue that when the intent is to predict or understand employee attitudes and behavior at work, employee ratings of job dimensions should be used because it is his/her perceptions of the objective job which foster work outcomes (14:19-20).

Two intercorrelations among the JDS scales are presented in Table 17 and Table 18. The correlations in Table 17 were computed across all 6930 respondents. In Table 18 respondent scores for each job were averaged and the mean scores for the 876 jobs were correlated. The resulting patterns of the two correlations were quite similar. The job dimensions themselves are moderately intercorrelated. This is to be expected because good jobs are often good in several of the dimensions measured. Conversely, bad jobs are often bad in several of the

dimensions. This moderate level of intercorrelation among the job dimensions does not detract from their usefulness as separate job dimensions as long as researchers recognize and account for this fact when interpreting the scores of jobs on a given dimension (14:23-26). In addition, there is substantial intercorrelation between the core job dimensions and the psychological states which are both substantially and positively related to the outcome measures (18:11).

Finally, the substantive validity of the JDS was evaluated. The variables were generally found to relate to one another as predicted by the job characteristics model. Of particular note was the positive relationship between MPS and the three critical psychological states, general satisfaction, growth satisfaction, and internal work motivation. Based on all of the evidence presented, the JDS is considered a valid measure of the theory concepts (14:26-27).

TABLE 16

INTERNAL CONSISTENCY RELIABILITIES OF THE JDS SCALES (18:10)

JDS SCALE	N[1]	RELIABILITY[2]
Skill Variety	3	.68
Task Identity	3	.61
Task Significance	3	.58
Autonomy	3	.64
Feedback From Job	3	.68
Feedback From Agents	3	.75
Dealing With Others	3	.62
Experienced Meaningfulness	4	.71
Experienced Responsibility	6	.67
Knowledge of Results	4	.71
General Satisfaction	5	.77
Internal Motivation	6	.69
Pay Satisfaction	2	.86
Security Satisfaction	2	.73
Social Satisfaction	3	.64
Supervisory Satisfaction	3	.87
Growth Satisfaction	4	.84
Would Like GNS	6	.87
Job Choice GNS	12	.71
Total GNS	18	.88

Note. N throughout about 6930 with small variations due to missing data.

[1]Number of items composing each scale.

[2]Reliabilities were calculated by obtaining the average interitem correlation for all items which are scored on each scale and then adjusting the median by Spearman-Brown procedures to obtain an estimate of the reliability of the scale score.

TABLE 17

INTERCORRELATIONS AMONG JDS SCALE SCORES
(ACROSS 6930 RESPONDENTS)
(18:13)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. SKILL VARIETY	22	42	44	34	18	39	61	45	34	15	33	34	09	21	26	15	48	12	14	15	
2. TASK IDENTITY	19	30	23	16	-01	46	22	27	19	20	16	06	14	14	12	24	06	05	07		
3. TASK SIGNIFICANCE	32	34	18	29	51	45	32	22	29	33	10	18	26	15	38	12	02	09			
4. AUTONOMY	39	27	25	79	42	39	29	42	31	21	29	33	31	54	08	07	09				
5. JOB FEEDBACK	38	19	76	39	36	49	35	32	20	27	27	29	40	11	06	11					
6. FEEDBACK (AGENTS)	14	37	29	23	39	32	25	25	27	27	52	36	02	00	02						
7. DEALING W/OTHERS	29	20	14	04	13	22	07	12	25	10	23	17	14	19							
8. MPS	52	47	43	46	40	22	33	38	33	59	17	14	19								
9. EXPERIENCED MEANINGFULNESS	58	40	66	57	27	33	41	36	65	-00	-07	-08									
10. EXPERIENCED RESPONSIBILITY	34	49	59	24	30	37	36	51	12	07	12										
11. KNOWLEDGE OF RESULTS	42	22	22	31	26	36	39	02	-04	-01											
12. GENERAL SATISFACTION	43	42	48	47	50	69	-06	-09	-08												
13. INTERNAL MOTIVATION	22	25	35	30	48	14	03	11													
14. PAY SATISFACTION	45	28	41	43	-05	-02	-05														
15. SECURITY SATISFACTION	38	47	51	05	05	06															
16. SOCIAL SATISFACTION	44	57	07	-01	04																
17. SUPERVISORY SATISFACTION	55	02	00	01																	
18. GROWTH SATISFACTION	-03	-08	-07																		
19. WOULD LIKE GNS	42	90																			
20. JOB CHOICE GNS	77																				
21. TOTAL GNS																					

TABLE 18

INTERCORRELATIONS AMONG JDS SCALE SCORES
(ACROSS 876 JOBS)
(18:14)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. SKILL VARIETY	26	47	59	42	23	37	60	32	23	08	37	41	14	19	19	10	45	07	12	07
2. TASK IDENTITY		21	36	31	13	05	42	08	08	05	22	23	08	10	12	11	25	-02	-05	00
3. TASK SIGNIFICANCE			43	41	25	32	48	40	30	25	38	42	23	28	25	13	39	14	09	09
4. AUTONOMY				51	28	29	75	32	27	17	48	44	25	32	32	22	54	08	11	10
5. JOB FEEDBACK					25	21	69	26	24	25	39	42	23	29	28	19	46	09	11	08
6. FEEDBACK (AGENTS)						50	28	57	54	56	29	25	27	26	24	33	36	38	38	19
7. DEALING W/OTHERS							28	57	58	47	12	22	16	23	31	11	30	56	58	30
8. MPS								32	25	19	46	46	28	34	36	44	58	13	16	39
9. EXPERIENCED MEANINGFULNESS									90	80	39	38	26	28	20	24	42	56	50	37
10. EXPERIENCED RESPONSIBILITY										81	24	31	20	23	21	17	28	64	64	41
11. KNOWLEDGE OF RESULTS											20	17	17	23	17	15	23	58	56	34
12. GENERAL SATISFACTION												47	48	54	50	46	71	00	02	02
13. INTERNAL MOTIVATION													37	41	42	35	56	16	14	16
14. PAY SATISFACTION														59	46	41	57	15	18	11
15. SECURITY SATISFACTION															56	46	63	23	26	20
16. SOCIAL SATISFACTION																51	74	32	33	26
17. SUPERVISORY SATISFACTION																	57	16	18	43
18. GROWTH SATISFACTION																		22	25	18
19. WOULD LIKE GNS																			88	60
20. JOB CHOICE GNS																				60
21. TOTAL GNS																				

APPENDIX E

EXPANDED MEASURES FOR DATA ANALYSIS

TABLE 19

JOB DIAGNOSTIC SURVEY NATIONAL NORMS

JOB CHARACTERISTICS	MEAN	STD DEV
Skill Variety	4.53	1.57
Task Identity	4.65	1.44
Task Significance	5.49	1.25
Autonomy	4.78	1.39
Feedback from Job	4.81	1.34
Feedback from Agents	4.06	1.58
Dealing with Others	5.46	1.31
CRITICAL PSYCHOLOGICAL STATES		
Experienced Meaningfulness	5.10	1.14
Experienced Responsibility	5.40	.96
Knowledge of Results	5.04	1.14
AFFECTIVE OUTCOMES		
General Satisfaction	4.65	1.27
Growth Satisfaction	4.74	1.33
Internal Work Motivation	5.50	.89
CONTEXT SATISFACTIONS		
Job Security	4.76	1.48
Pay	4.16	1.66
Co-workers	5.31	1.02
Supervision	4.79	1.57
INDIVIDUAL GROWTH NEED STRENGTH	5.64	1.22
MOTIVATING POTENTIAL SCORE (MPS)	122.10	69.41

Note: These norms were compiled by Hackman, Oldham, and Stepina. They are based on the responses of 6930 employees who work on 876 different jobs in 56 organizations (18:12).

TABLE 20

INTERCORRELATIONS AMONG JOB CHARACTERISTICS
AND ATTITUDE INDICES (BOMB-NAVIGATION MECHANICS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SKILL VARIETY		17	33	13	24	02	25	35	28	-06	13	21	08	41	02	38
2. TASK IDENTITY			12	29	08	07	-14	15	10	02	09	01	14	22	-14	33
3. TASK SIGNIFICANCE				18	31	19	30	16	28	-08	13	23	16	29	14	43
4. AUTONOMY					20	18	05	13	08	07	19	02	21	39	-04	77
5. JOB FEEDBACK						30	18	29	28	01	18	18	22	36	17	71
6. FEEDBACK (AGENTS)							26	33	17	15	15	42	63	32	01	31
7. DEALING W/OTHERS								02	10	-03	-02	30	23	18	13	14
8. JOB SATISFACTION									44	00	35	47	38	66	00	34
9. INTERNAL MOTIVATION										-21	25	33	29	49	17	29
10. PAY SATISFACTION											27	18	25	16	08	07
11. SECURITY SATISFACTION												33	21	49	17	29
12. SOCIAL SATISFACTION													47	60	-04	20
13. SUPERVISORY SATISFACTION														47	17	29
14. GROWTH SATISFACTION															08	56
15. GNS																02
16. MPS																

Note: For $|r| \geq .27$, $p \leq .001$.

TABLE 21

INTERCORRELATIONS AMONG JOB CHARACTERISTICS
AND ATTITUDE INDICES (AIRCRAFT MAINTENANCE SPECIALISTS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SKILL VARIETY		22	55	46	47	26	48	60	49	17	24	39	35	65	-02	67
2. TASK IDENTITY			10	20	19	07	05	15	-01	14	-04	19	00	15	09	39
3. TASK SIGNIFICANCE				19	56	33	53	47	54	08	28	29	40	50	14	44
4. AUTONOMY					27	18	22	37	31	21	29	19	36	55	-05	84
5. JOB FEEDBACK						30	29	52	52	19	27	41	30	55	23	65
6. FEEDBACK (AGENTS)							22	40	27	25	33	44	57	40	02	31
7. DEALING W/OTHERS								33	38	10	26	21	32	42	-05	29
8. JOB SATISFACTION									61	38	37	50	50	82	05	55
9. INTERNAL MOTIVATION										30	33	37	34	61	13	44
10. PAY SATISFACTION											26	32	30	38	00	23
11. SECURITY SATISFACTION												23	26	45	08	28
12. SOCIAL SATISFACTION													53	48	21	39
13. SUPERVISORY SATISFACTION														55	-09	43
14. GROWTH SATISFACTION															00	68
15. GNS																08
16. MPS																

Note: For $|r| \geq .32$, $p \leq .001$.

TABLE 22

INTERCORRELATIONS AMONG JOB CHARACTERISTICS
AND ATTITUDE INDICES (MUNITIONS SYSTEMS SPECIALISTS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SKILL VARIETY		25	38	34	49	22	22	53	32	-09	10	36	13	50	01	57
2. TASK IDENTITY			15	37	39	31	-05	34	09	17	23	37	31	38	16	51
3. TASK SIGNIFICANCE				27	35	21	34	39	29	-08	26	40	18	35	10	41
4. AUTONOMY					46	44	11	38	32	03	-13	50	41	57	24	41
5. JOB FEEDBACK						39	18	38	39	03	22	48	27	55	22	78
6. FEEDBACK (AGENTS)							08	31	20	15	09	47	50	44	24	49
7. DEALING W/OTHERS								11	14	-20	-07	27	06	16	-08	19
8. JOB SATISFACTION									43	14	50	57	43	69	14	48
9. INTERNAL MOTIVATION										17	35	37	19	46	25	42
10. PAY SATISFACTION											32	18	36	21	14	-02
11. SECURITY SATISFACTION												40	34	37	17	18
12. SOCIAL SATISFACTION													55	72	16	55
13. SUPERVISORY SATISFACTION														56	16	39
14. GROWTH SATISFACTION															19	65
15. GNS																29
16. MPS																

Note: For $|r| \geq .27$, $p \leq .001$.

TABLE 23

INTERCORRELATIONS AMONG JOB CHARACTERISTICS
AND ATTITUDE INDICES (ALL MAINTENANCE PERSONNEL)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SKILL VARIETY		25	38	31	43	15	14	48	40	-04	15	25	14	54	08	55
2. TASK IDENTITY			13	31	26	18	-11	24	08	10	12	19	17	29	07	44
3. TASK SIGNIFICANCE				21	40	23	36	34	37	-03	22	32	22	38	13	42
4. AUTONOMY					32	29	10	31	25	09	20	23	33	51	08	81
5. JOB FEEDBACK						33	16	40	41	05	23	34	25	50	23	73
6. FEEDBACK (AGENTS)							18	34	21	17	18	42	56	38	10	38
7. DEALING W/OTHERS								12	15	-02	04	26	19	18	-03	14
8. JOB SATISFACTION									50	16	41	33	26	53	21	47
9. INTERNAL MOTIVATION										07	31	33	26	53	21	40
10. PAY SATISFACTION											28	22	30	23	07	06
11. SECURITY SATISFACTION												32	27	43	15	24
12. SOCIAL SATISFACTION													49	59	10	36
13. SUPERVISORY SATISFACTION														50	01	36
14. GROWTH SATISFACTION															13	64
15. GNS																20
16. MPS																

Note: For $|r| \geq .17$, $p \leq .001$.

SELECTED BIBLIOGRAPHY

A. REFERENCES CITED

1. "An Air Force Almanac," Air Force Magazine, May 1983, pp. 165-181.

2. Assistant Chief of Air Staff, Intelligence Historical Division. Individual Training in the AAF. (Washington: Army Air Force, December 1944), p.1.

3. Campbell, Wendy. Air Force Human Resources Laboratory, Wright-Patterson AFB OH. Personal Interview. 14 January 1983.

4. Campbell, Wendy, and Andrew P. Chenzoff. "A Qualitative Methodology for Studying Air Force Maintenance," Unpublished research report, Air Force Human Resources Laboratory, Wright-Patterson AFB OH, 1981.

5. "Chiefs Need Seen in Maintenance Manning," Air Force Times, March 9, 1981, p.4.

6. Cook, Captain Douglas P., and Captain Harry J. Devault, USAF. "A Qualitative Analysis of SAC Aircraft Maintenance." Unpublished master's thesis, LSSR 17-82, AFIT/LS, Wright-Patterson AFB OH, August 1982. AD A122815.

7. Desch, Lieutenant Colonel Gerald D., USAF. "Retention of Aircraft Maintenance Technicians." Unpublished research report No. 320, Air War College, Maxwell AFB AL 1978.

8. Eaker, Lieutenant General Ira C. "A Tribute to the Mechanic," TAC Attack, March 1975, p.11.

9. Ford, Robert N. "Job Enrichment Lessons From AT&T," Harvard Business Review, January-February 1973, pp. 96-106.

10. "GAO to Services: Use Resources Better," Air Force Times, May 10, 1982, p.8.

11. Griffin, Ricky W., Ann Welsh, and Gregory Moorhead. "Perceived Task Characteristics and Employee Performance: A Literature Review," Academy of Management Review, October 1981, pp. 655-664.

12. Guthrie, Captain Walter J., USAF. "A Study of Job Characteristics and Job Attitudes at a Tactical Air Command Fighter Aircraft Maintenance Complex." Unpublished master's theses. AFIT/GSM/SM/77S-5, Wright-Patterson AFB OH, 1977. AD A045998.

13. Hackman, J. Richard, and Edwin E. Lawler III. "Employee Reactions to Job Characteristics," Journal of Applied Psychology Monograph, June 1971, pp. 259-286.

14. Hackman, J. Richard, and Greg R. Oldham. The Job Diagnostic Survey: An Instrument for the Diagnosis of Job and the Evaluation of Job Redesign Projects. Department of Administrative Sciences, Yale University, May 1974.

15. _____ and Greg R. Oldham. "Motivation Through the Design of Work: Test of a Theory," Organizational Behavior and Human Peformance, August 1976, pp. 250-279.

16. _____ and Greg R. Oldham. "A New Strategy for Job Enrichment," California Management Review, Summer 1975, pp. 57-71.

17. _____ and Greg R. Oldham. Work Redesign. Reading, Massachusetts: Addison-Wesley Publishing Company, 1980.

18. _____, Greg R. Oldham, and Lee P. Stepina. "Norms for the Job Diagnostic Survey." JSAS Catalog of Selected Documents in Psychology, MS 1819, 1979.

19. Herzberg, Frederick, and Bernard Mausner. The Motivation to Work. 2d ed. New York: John Wiley and Sons, Inc., 1959.

20. House, Robert J., and Lawrence A. Wigdor. "Herzberg's Dual-Factor Theory of Job Satisfaction and Motivation: A Review of the Evidence and a Criticism," Personnel Psychology, Winter 1967, pp. 369-389.

21. Mace, Don. "Five Skills Added to Shortages," Air Force Times, January 31, 1983, p.3.

22. McCarthy, James R. "A Quarter Century of Air Force Maintenance," Aerospace Historian, Spring/March 1982, pp. 48-55.

23. McClave, James T., and P. George Benson. Statistics For Business and Economics. 2d. ed. Santa Clara CA: Dellen Publishing Co., 1982.

24. Nie, Norman H., and others. Statistical Package for the Social Sciences (SPSS). 2d. ed. New York: McGraw-Hill Book Company, 1975.

25. Oldham, Greg R., J. Richard Hackman, and Jon L. Pierce. "Conditions Under Which Employees Respond Positively to Enriched Work," Journal of Applied Psychology, August 1976, pp. 395-403.

26. Paul, William J., Keith B. Robertson, and Frederick Herzberg. "Job Enrichment Pays Off," Harvard Business Review, March-April 1969, pp. 61-78.

27. Peppers, Jerome G. Jr. Associate Dean, School of Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB OH. Personal interviews conducted intermittently from 14 January 1983 to 22 July 1983.

28. Philpott, Tom. "JCS: Freeze on Pay Threat to Readin ss," Air Force Times, January 31, 1983, p.1.

29. Pierce, Captain Gary W., and Captain Erika A. Robeson, USAF. "Attitudes and Opinions of USAF Jet Engine Personnel Concerning Enlisted Career Progression." Unpublished master's thesis. LSSR 2-80, AFIT/LS, Wright-Patterson AFB OH, June 1980. AD A087444.

30. Pierce, Jon L., and Randall B. Dunham. "Task Design: A Literature Review," Academy of Management Review, October 1976, pp.83-97.

31. _____, Randall B. Dunham, and Richard S. Blackburn. "Social Systems Structure, Job Design, and Growth Need Strength: A Test of a Congruency Model," Academy of Management Journal, June 1979, pp. 223-240.

32. "Recruit Dropout Rate Tied to Experiences," Air Force Times, January 25, 1982, p. 1.

33. Roberts, Karlene H., and William Glick. "The Job Characteristics Approach to Task Design: A Critical Review," Journal of Applied Psychology, April 1981, pp. 193-217.

34. Rousseau, Denise M. "Technological Differences in Job Characteristics, Employee Satisfaction, and Motivation: A Synthesis of Job Design Research and Socio-technical Systems Theory," Organizational Behavior and Human Performance, June 1977, pp. 18-42.

35. Steers, Richard M., and Richard T. Mowday. "The Motivational Properties of Tasks," Academy of Management Review, October 1977, pp. 645-658.

36. Steers, Richard M., and Lyman W. Porter. Motivation and Work Behavior. 2d. ed. New York: McGraw-Hill, Inc., 1979.

37. Townsend, Major Gene E., USAF. "Air Force Maintenance - Issues and Challenges for the Eighties," Air Force Magazine, January 1980, pp. 56-61.

38. Turner, A. N., and P. R. Lawrence. Industrial Jobs and the Worker. Boston: Harvard Graduate School of Business Administration, 1965.

39. U.S. Department of the Air Force. Aircraft Maintenance (Deputy Commander for Maintenance). AFR 66-1, Vol I, Washington: Government Printing Office, 2 January 1980.

40. _____. Airman Classification. AFR 39-1, Washington: Government Printing Office, 1 January 1982.

41. _____. Functional Management Inspection of Training Development in Enlisted Technical Training. United States Air Force Inspector General PN80-619, Washington: Government Printing Office, May 1981.

42. _____. Maintenance Management Policy. AFR 66-1, Vol I, Washington: Government Printing Office, 2 January 1980.

43. _____. Squadron Maintenance. AFR 66-1, Vol III, Washington: Government Printing Office, 2 January 1980.

44. Umstot, Denis D., Cecil H. Bell Jr., and Terence R. Mitchell. "Effects of Job Enrichment and Task Goals on Satisfaction and Productivity: Implications for Job Design," Journal of Applied Psychology, August 1976, pp. 379-394.

45. _____ and William E. Rosenbach. "From Theory to Action: Implementing Job Enrichment in the Air Force," Air University Review, March-April 1980, pp. 74-81.

46. Walker, Charles R. "The Problem of the Repetitive Job," Harvard Business Review, May 1950, pp. 54-58.

47. Whitsett, David A. and Erik K. Winslow. "An Analysis of Studies Critical of The Motivation-Hygiene Theory," Personnal Psychology, Winter 1967, pp.391-416.

48. Wray, Bernard. "Stop the Hemorrage of Talent," Air University Review, January-February 1981, pp. 71-76.

49. Yorks, Lyle. Job Enrichment Revisited. New York: AMACOM, 1979.

B. RELATED SOURCES

Air Force Institute of Technology. Style and Guidelines Manual for Theses and Technical Reports. Wright-Patterson AFB OH, April 1980.

Emory, C. William. Business Research Methods. Rev ed. IL: Richard D. Irwin, Inc., 1980.

Ford, Robert N. Why Jobs Die and What to Do About It. New York: AMACOM, 1979.

Maher, John R. New Perspectives in Job Enrichment. New York: Van Nostrand Reinhold Company, 1971.


ME
8